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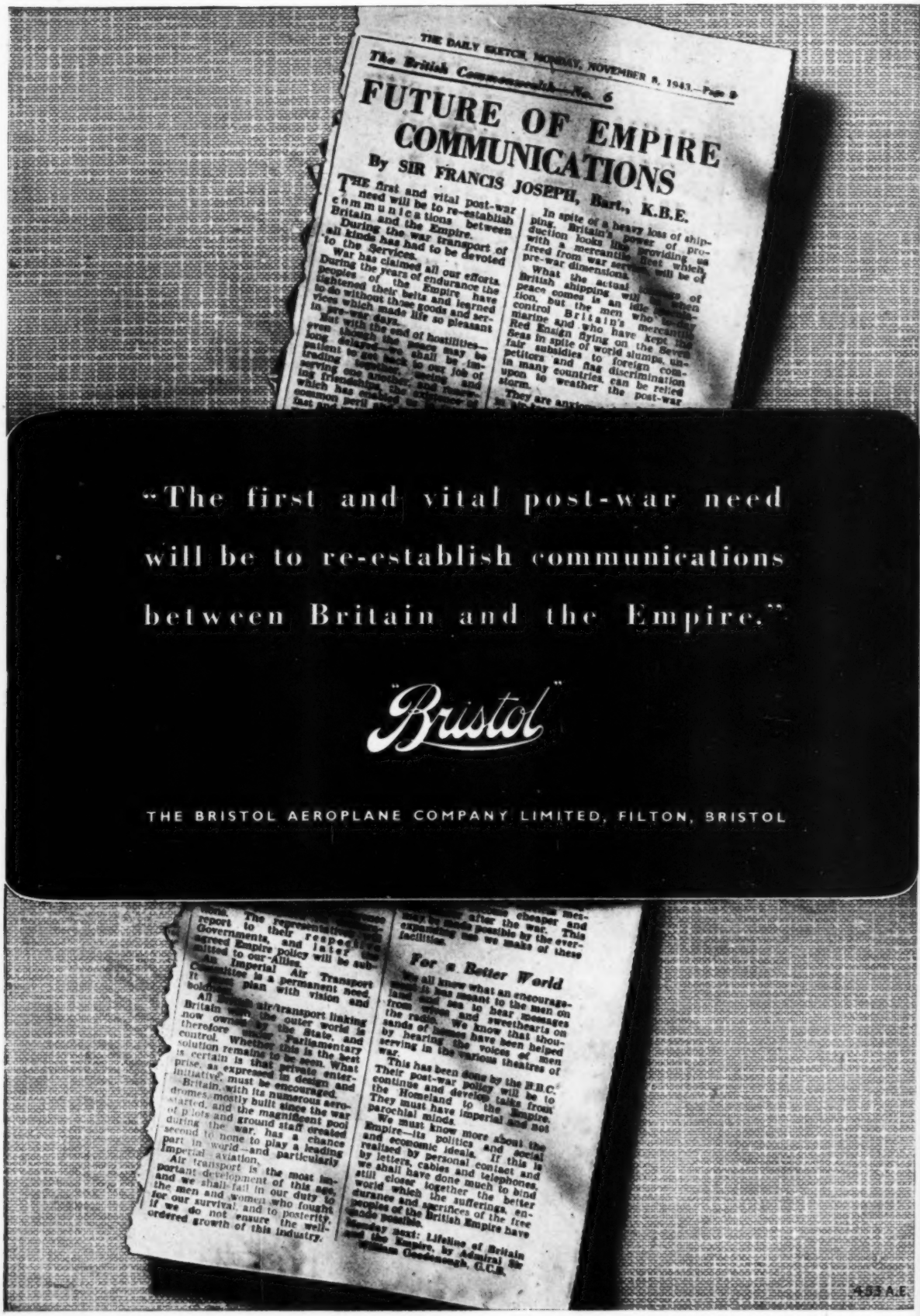
FLIGHT

and The AIRCRAFT ENGINEER

OFFICIAL ORGAN OF THE ROYAL AERO CLUB

JANUARY 13th, 1944


THE DAILY SKETCH, MONDAY, NOVEMBER 8, 1943.—Page 9
The British Commonwealth—No. 6
FUTURE OF EMPIRE COMMUNICATIONS
By SIR FRANCIS JOSEPH, Bart., K.B.E.
THE first and vital post-war need will be to re-establish communications between Britain and the Empire.
During the war transport of all kinds has had to be devoted to the Services.
War has claimed all our efforts. During the years of endurance the peoples of the Empire have tightened their belts and learned to do without those goods and services which made life so pleasant in pre-war days.
But with the end of hostilities—even though the peace may be long delayed—we shall be impatient to get back to our job of trading together, serving one another, meeting and renewing friendships, the severance of which has created for us all a common peril and
In spite of a heavy loss of shipping, Britain's power of production looks like providing us with a mercantile fleet which, freed from war service, will be of pre-war dimensions.
What the actual British shipping will be when peace comes is an idle question, but the men who control Britain's mercantile marine and who have kept the Red Ensign flying on the Seven Seas in spite of world slumps, unfair subsidies to foreign competitors and flag discrimination in many countries, can be relied upon to weather the post-war storm.
They are anxio
"The first and vital post-war need will be to re-establish communications between Britain and the Empire."
Bristol
THE BRISTOL AEROPLANE COMPANY LIMITED, FILTON, BRISTOL
cheaper and after the war. This made possible by the ever- use we make of these facilities.
For a Better World
We all know what an encouragement it has meant to the men on land and sea to hear messages from wives and sweethearts on the radio. We know that thousands of homes have been helped by hearing the voices of men serving in the various theatres of war.
This has been done by the B.B.C. Their post-war policy will be to continue and develop links from the Homeland to the Empire. They must have imperial and not parochial minds.
We must know more about the Empire—its politics and social and economic ideals. If this is realised by personal contact and by letters, cables and telephones, we shall have done much to bind still closer together the better world which the sufferings, endurance and sacrifices of the free peoples of the British Empire have made possible.
Monday next: Lifeline of Britain and the Empire, by Admiral Sir William Goodenough, G.C.B.
report to their respective Governments, and later the agreed Empire policy will be submitted to our Allies.
An Imperial Air Transport Committee is a permanent need. It must plan with vision and boldness.
All British air transport linking Britain with the outer world is now owned by the State, and therefore under Parliamentary control. Whether this is the best solution remains to be seen. What is certain is that private enterprise, as expressed in design and initiative, must be encouraged.
Britain, with its numerous aerodromes, mostly built since the war started, and the magnificent pool of pilots and ground staff created during the war, has a chance second to none to play a leading part in world—and particularly Imperial—aviation.
Air transport is the most important development of this age, and we shall fail in our duty to the men and women who fought for our survival and to posterity if we do not ensure the well-ordered growth of this industry.
453 A.E.

FLIGHT and The AIRCRAFT ENGINEER

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The Outlook

The Whittle-Carter Combination

THE most jealously guarded secret in modern aviation history, and at the same time the best-known, was suddenly revealed on January 6th when a joint statement was issued by the War Department, Washington, on behalf of the Royal Air Force and the U.S. Army Air Forces, mentioning for the first time the existence of the jet-propelled Gloster monoplane. The secret had been well guarded because no hint had ever been given in any English journal that this country was even experimenting with jet propulsion. It was the best known because thousands of people up and down the country had seen and heard the machine. When, after preliminary tests, it was sent up to an airfield in Lincolnshire, we began to receive letters by the dozen from readers living in that part of England, asking us what this new weird aircraft was which flew about at terrific speeds and had no airscrew. Secrecy regulations prevented us from enlightening them, and the enquiries have continued to come in right up to the present as the machines were flown over different parts of the country. Now it will be unnecessary for us to tell them "white lies" in the interests of national security. They will know that when they see such an apparition it is a jet-propelled machine.

That the announcement should be made just now, and that it should be a joint statement by America and Great Britain, is just and proper. The development work has been to a considerable extent a co-operative affair, and the interchange of information gained on both sides of the Atlantic cannot but hasten the development of this form of propulsion. But it is equally just and proper that it should be fully realised that British inventiveness and genius, on the one hand, and British official appreciation of the possibilities, on the other, should be given the credit for the pioneer work done by Great Britain in this field of endeavour, which is so fraught with startling progress.

The two men to whom, first of all, should go the credit are Group Captain Frank Whittle, who began work on his schemes in 1933, and Mr. W. G. Carter, Gloster's chief designer, who produced the aircraft for the Whittle power unit. Both were successful in their way, and the time taken to get the aircraft into the air was remarkably short, considering all the novel features which had to be studied.

Praise must also be given to those officers and officials of the Air Ministry and Ministry of Aircraft Production who realised that if the experiments were successful, the way would be opened to a new era in flying, for that is what jet propulsion means. There are many problems still to be solved, fuel consumption being one of the more important. That is very largely a matter of compression. In the case of the reciprocating engine it was the 100 octane fuel which enabled engine designers to use compression ratios far higher than those at which knocking set in with the older fuels, and thus to get more power and better fuel economy from their engines. With jet propulsion the problem is not one of anti-knock values, but of pre-compressing the air before it enters the firing chamber in which the continuous combustion takes place. There are, of course, many aspects of the problem, but British engineers have successfully solved the fundamental ones and will without doubt solve the others.

The co-operation between the United States and Great Britain has taken place since the first British experiments were made. We have sent power plants to America, where the Bell company (makers of the Airacobra) built

an aircraft to use two of the Whittle units. The American G.E.C. has taken up development, and there is little doubt that the experience of that firm with the Moss exhaust-driven supercharger will prove valuable since turbo-blowers or compressors will inevitably play a prominent part in jet-propulsion units of the future.

Future of Jet Propulsion

READERS of this journal will scarcely need to be reminded of the advantages of jet propulsion when it has been developed to a point where it can compete with the engine-airscrew combination. The complexities of the modern aircraft reciprocating engine are considerable, and the direct-reaction principle is fundamentally simple, mechanically speaking. It is, however, almost a foregone conclusion that before jet propulsion becomes really efficient a good deal of mechanical complication will have to be introduced. There does, however, seem to be no doubt that jet propulsion units will be simpler and lighter than reciprocating engines.

The remarkable thing about jet propulsion is that, from the point of view of reaction efficiency, it does not begin to score until very great forward speeds have been attained. One result of this is that the "power available" curve (in terms of thrust horse-power, of course) has a very different shape from that of an engine-airscrew combination. Within limits, in other words, the faster the aircraft flies the greater becomes the thrust because of the greater reaction efficiency. This at first sight looks like perpetual motion, but unfortunately the drag of the aircraft itself is not affected by the form of propulsion used; it follows the "speed squared" law, and ultimately balances the thrust and so sets a limit on further speed increase with that particular aircraft. So long as we remain in the atmosphere, liquid fuel can be used since air is available for the combustion of the fuel. Rocket propulsion could take over after that, since the powder will burn without air, but as has been shown in articles we have published, the weight of powder fuel is considerable and flight durations thus likely to be short.

With pressurised cabins and jet propulsion there is, however, no reason why flight at altitudes far greater than any hitherto attained, and at speeds very much higher, should not become possible during the next few years. The Gloster-Whittle combination is but a first step. We may regard it as the 1941 equivalent of the Wright 1903 biplane. If one remembers that the Wrights flew at about 40 m.p.h. and for a few minutes only, and compares that with the present ranges of 3,000 miles or so while still carrying a useful load of bombs, it is not difficult to appreciate that jet propulsion may make aircraft of 1944 look somewhat curious in 1984, for instance.

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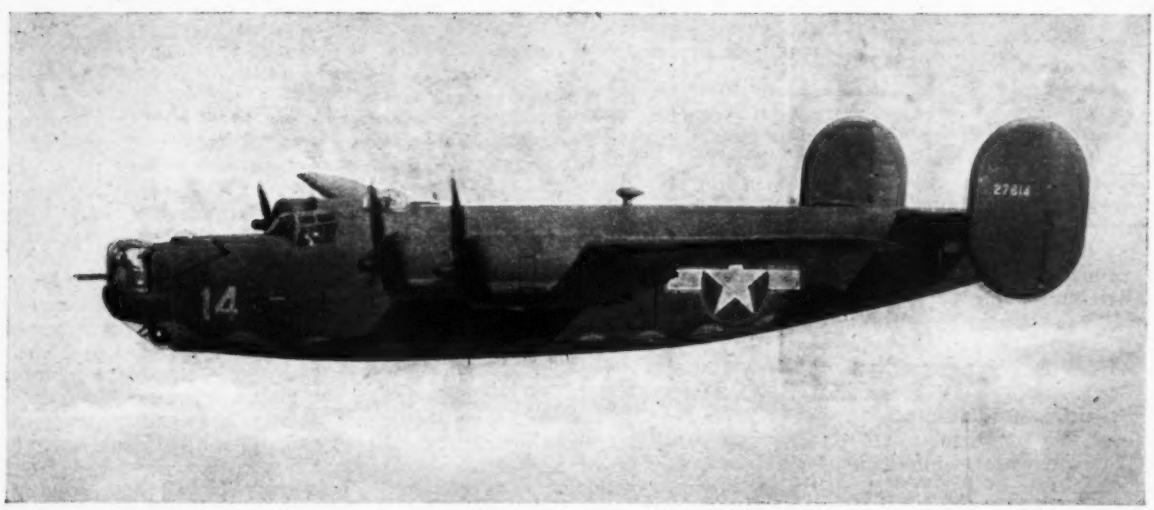
Changes in High Commands

MORE than personal interest attaches to the selection of Air Marshal Sir John Slessor as deputy to General Eaker in the Mediterranean Command. At the same time Air Chief Marshal Sir Sholto Douglas quits the command of the Middle East to take over Coastal Command. The Middle East Command of the R.A.F. will now, apparently, cease to have a separate existence, and this is a logical consequence of recent developments in the Mediterranean.

General Eaker and Sir John Slessor will, we presume, be mainly concerned with tactical air operations, leaving strategic bombing to General Twining. Hitherto, General Eaker has been concerned with strategical bombing, but Sir John Slessor is an authority on the tactical use of air power. He has been an instructor at the Army Staff College at Camberley, and his book, *Air Power and Armies*, published in 1936, is a classic.



FORD BUILT : A Liberator from the Ford factory at Willow Run on test. It has the new Emerson power-operated nose-turret mounting two 0.5in. machine guns.

The dome and golden cross of St. Paul's Cathedral silhouetted against a cone of London searchlights.

WAR in the AIR

A Crescendo of Day-bombing : German Conservation Policy : Why Not Ploesti Again?

LAST week there was another crescendo. The word is rather overworked nowadays, but it expresses a sudden output of furious attack more vividly than any other. This time it means day attack on military targets in northern France, and, beginning with the New Year, that offensive created new records for sorties of light and medium bombers and fighter-bombers, sometimes with fighter escort and sometimes without it.

If Hitler has any of his boasted "secret weapons" in that area, their lairs must have been as secret as their mechanism if they escaped the far-flung strafing of the Marauders, Typhoons, and other aircraft which raged over that part of France.

The most interesting feature of the operations was the German reaction to the attack. Paradoxically, they reacted by displaying no reaction, and that is what is so interesting. Only occasionally were German fighters seen by the Allied airmen, but of resolute defence there was no sign at all. It has repeatedly been mentioned in these columns that the enemy policy is now one of conservation in the matter of aircraft, and especially of fighters, but the crews of our heavy bombers know well that when a deep penetration is made into Germany by either night or day, the fighter pilots of the *Luftwaffe* will hurl themselvs against the raiders with abandon, showing both courage and skill. It follows that their passive submission to the Allied raiding of northern France must be a matter of deliberate policy. Either the lords of the *Luftwaffe* are reserving their fighter strength to resist only the deep penetrations and raids on vital targets, or they are building up with the idea of making the invasion of Europe as expensive as possible for the Allies. If the latter consideration is chiefly in their minds, it becomes obvious that they have been studying

JAPANESE DESCENT : A Kawanishi 4-engined flying boat, known to the Americans as a Mavis, falling in flames after an encounter with a Catalina and a Liberator.

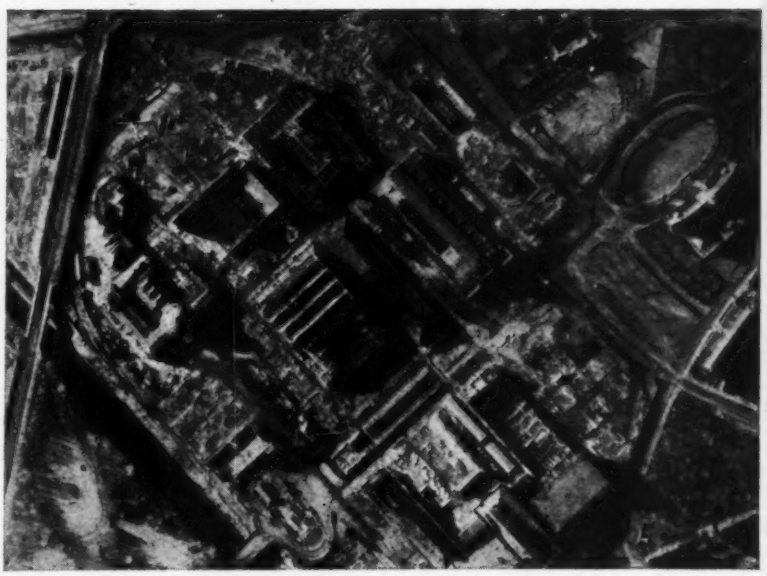
WAR IN THE AIR

the maxims of Gen. Montgomery and the methods of Sir Arthur Tedder, and know that the air battle must be won first, before the land battle has much chance of success. Only in mountainous terrain (e.g., the Apennines) do they feel that they can disregard the importance of air mastery without incurring speedy disaster.

It is also interesting and significant that British authorities have learnt that during the past twelve months the Germans have succeeded in increasing their first-line strength in fighters by some 1,000 machines. There has been no corresponding increase in their bomber strength. In fact, that section of the *Luftwaffe* has suffered in various ways. Apart from substantial losses of *bona fide* bombers in the Mediterranean and to some extent in Russia, the Germans during the past year have used as troop transports, as night-fighters and as long-range fighters numbers of machines which would have been useful for training bomber pilots and aircrews. Once the regular production of bomber aircrews has fallen into arrears, it is no easy matter to catch up again. The Germans have evidently decided that that sacrifice was worth while, as their air strategy is now purely defensive.

An increase of 1,000 in first-line strength is no mean effort; for behind the first line there must always be immediate reserves in each squadron and also regular replacements of losses in combat and of other machines suffering from normal wear and tear, which is naturally greater in time of war than in the piping times of peace. But for the Allied, and especially the American, bombing attacks on fighter factories in Southern Germany and Austria the increase might have been even greater.

In the past year the Germans have displayed ingenuity in the design and production of various devices, such as rocket bombs, but they have not produced any new aircraft types of notable merit. The four-engined bomber, the Heinkel 177, is now appearing in some numbers, but it went through a lot of teething troubles before it was passed as fit for mass production and service. It is believed to be now worth using but not highly satisfactory.

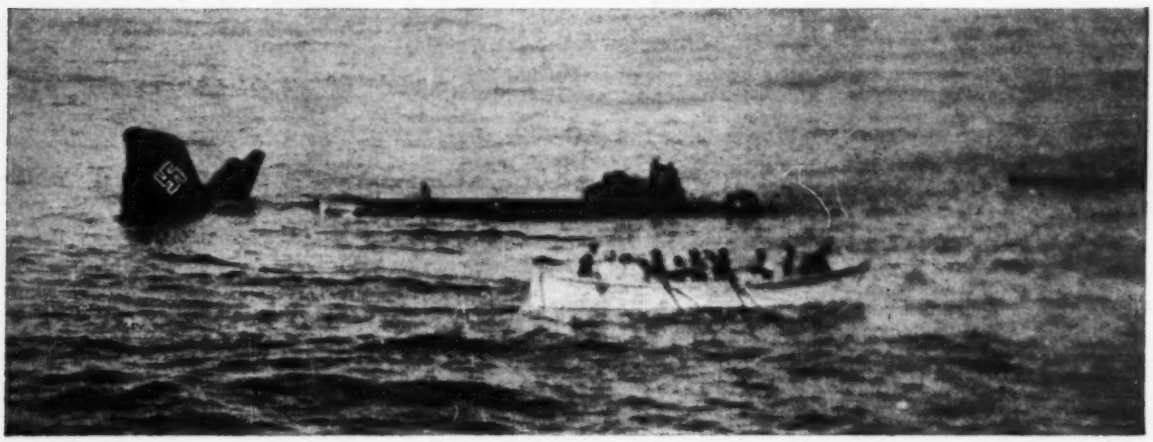


ALL'S FAIR: A hundred acres of the famous fair ground at Leipzig was devastated in the recent 1,500-ton raid by Bomber Command.

The Rumanian Oilfields

THERE are some commentators who believe that nothing would do more to shorten the war than the cutting off of Germany's supplies of Rumanian oil. They may well be right. American bombers, starting from Africa, have bombed Ploesti once, but since that solitary effort the place has been left alone, and by now the damage done has probably been made good.

Naturally surprise has been felt that no more efforts have since been made to put the Ploesti wells out of action. When the Allies in Italy seized Foggia, there was general expectation that renewed attacks would be made on the place, but so far nothing has happened. Correspondents on the Russian front have suggested that when the Red Army clears the Germans out of the Crimea, that peninsula would make a useful base for bombing the Rumanian oilfields. But strategic bombing has not been highly developed by the Russians, and one would certainly expect blows from the air to be delivered by the experienced British and American heavy bomber forces rather than by the inexperienced Russians. Perhaps Marshal Stalin hopes that before long his armies will have forced their way across the Rumanian frontier and seized Ploesti from the ground. They have still a long way to go, and though time is



BROUGHT TO BAY: Survivors of a Focke Wulf 200 being picked up after being shot down into the Bay of Biscay.

FREE DUTCH : Bombing up Mitchells of the Nederlands Air Force operating with the R.A.F.

WAR IN THE AIR

now on the side of the United Nations, everyone wants to end the war as soon as possible.

New things may perhaps be expected from the recent changes in commands between the Mediterranean and Great Britain. Lieut. Gen. Eaker is going to the Mediterranean, though not with such wide powers as were held by Air Chief Marshal Tedder. It is, however, worth recalling that the majority of the force which bombed Ploesti had been supplied from the Eighth Air Force in Great Britain, which was then under Gen. Eaker. He may have special information on the subject, and may hold his own views on what should be done. Gen. Twining actually commands the Fifteenth Air Force (composed of heavy bombers) in the Mediterranean, and we must presume that he and Gen. Eaker will work harmoniously together and in concert with the general plans of Gen. Sir Henry Maitland-Wilson. It would not be surprising if, when the weather permits, the new organisation in the Mediterranean results in further efforts to cut off the life blood of the German war machine.

ENEMY AIR LOSSES TO JAN. 8th

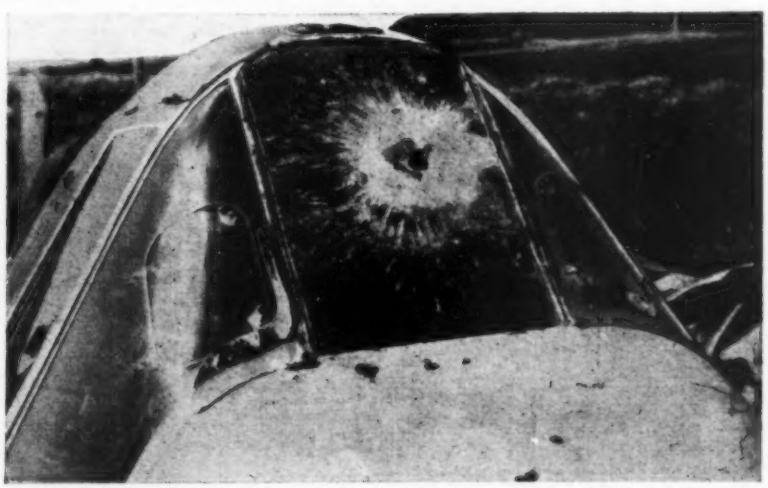
	Over G.B.	Continent	Middle East	N.W. Africa
Jan. 2	4	5	0	0
" 3	0	2	0	7
" 4	2	5	0	2
" 5	0	0	0	0
" 6	0	3	0	2
" 7	0	4	0	4
" 8	0	1	0	12
	6	20	0	27

Totals : West, 7,828 ; Middle East, over 5,760 ; North-West Africa, 3,917.

BRITISH & U.S. AIR LOSSES TO JAN. 8th

	Over G.B. A'crft.	Continent B'brs.	Continent F'trs.	Middle East A'crft.	N.W. Africa A'crft.
Jan. 2	0	27	2	0	2
3	0	0	7	0	3
4	0	20	7	0	0
5	0	40	12	0	1
6	0	0	6	2	0
7	0	13	10	0	4
8	0	1	1	0	3
	0	101	45	2	13

Totals : West, 9,126 ; Middle East, about 2,344 ; North-West Africa, 1,485.



ALTERED OUTLOOK : The safety glass windscreen after it had been struck by a 20 mm. shell. A shower of powdered glass came into the cockpit but the pilot was uninjured.

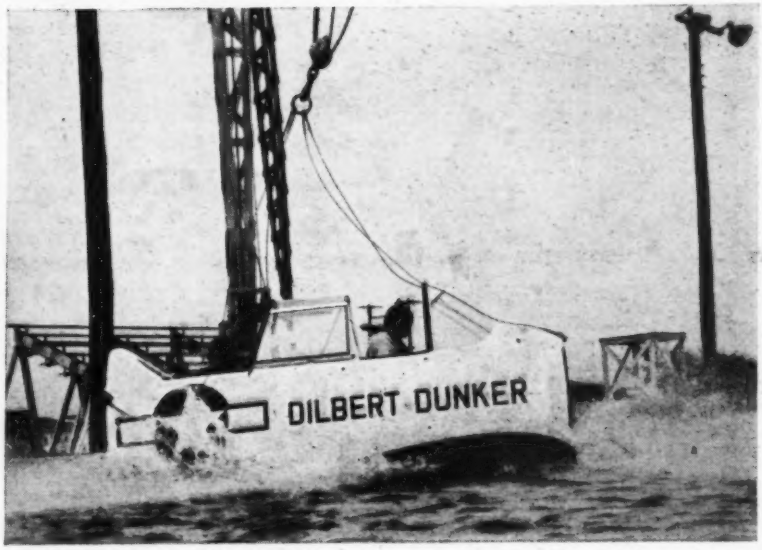
Artillery Observation

OCCASIONAL breaks in the bad weather in Italy allow Allied aircraft to get to work, but the breaks are rare. Very good work has been done by the Taylorcraft Austers in spotting for the guns. They are flown by officers of the R.A., trained by the R.A.F., but not seconded to it.

JET PROPULSION

THE official announcement of the successful adoption of jet propulsion units for fighter aircraft has led to a big demand for the booklet "Gas Turbines and Jet Propulsion for Aircraft," by G. Geoffrey Smith, M.B.E., issued by Flight Publishing Co., Ltd., Dorset House, Stamford Street, London, S.E.1. The publishers regret that owing to shortage of paper, the second edition became out of print in November and a further limited reprint priced at 3s. 6d. now being issued has been sold out before publication. Arrangements are being made for further supplies, when orders received will be dealt with in rotation. This *Flight* publication is the first and only book dealing exclusively with jet propulsion for aircraft, and includes early Whittle designs. By arrangement with *Flight* a reprint of the book is on sale in America by Aerosphere, 370, Lexington Avenue, New York City, price $1.25.

HERE AND THERE



DITCHING DRILL : To give aircrew cadets realistic practice in taking to their dinghies should they come down in "the drink," the U.S. Naval Air Training Centre at Corpus Christi, Texas, has evolved this "dunker." It hits the water with realistic force and sinks very quickly. "Dilbert" is the U.S. equivalent of P/O Prune.

Danger Past

THE Canadian Aircraft Detection Corps in Ontario, Manitoba and Western Quebec (the equivalent of our R.O.C.) has now been disbanded and more than 9,000 civilian observers thus released.

Discussion

NORTH-EAST London Supervisors' Discussion Group is to hold its next meeting at the South-west Essex Technical College, Walthamstow, on Tuesday, January 18th, at 7 p.m.

Dr. Stanley Walpole, D.Sc., is the guest speaker, and his subject will be "Technique in Joint Consultation."

Lisbon Story

A NEW sea airport for Lisbon, estimated to cost £500,000, is to be built on a more suitable site than the present one, two miles farther up the Tagus.

The projected works include a new dock with space to moor four or five aircraft, allowing room to manœuvre them, and a modern road connecting it with the land airport opened last year at Portela.

Spent on Research

CLEAR indication of the increasing sums of money spent on research in America before the war was recently provided by the results of an enquiry made by the industrial research committee of the U.S. Federal Board of Investigation.

This showed that 422 firms spent £1,736,000 on research in 1930, but in 1938 the total had risen to no less than £5,422,000 spent by 566 firms.

Increased expenditure on collective research provided equally impressive figures. In 1930 subscriptions totalling £162,000 and a grant of £93,000 from the Department of Scientific and Industrial Research were obtained by 18 research associations, while in 1938 there were 22 associations which received £362,000 in subscriptions and £177,000 in grants.

Indirect Transmission

A RECENT Reuter report says that the Turkish radio, quoting Swedish papers, recently stated that in their latest air attacks, the R.A.F. used a new type of aircraft equipped with a special infra-red ray apparatus by means of which normally invisible objects can be seen.

Not only that, but (according to Reuter's account of what the Turkish radio says the Swedish newspapers said —if you follow us !) "In spite of the most intense A.A. fire, these planes continue on their course undisturbed."

"Mars" Modifications

"EXTENSIVE internal changes" are to be made to the interior economy of the Glenn Martin "Mars" type of flying boat, 20 of which have been ordered by the U.S. Navy, according to Col. Frank Knox.

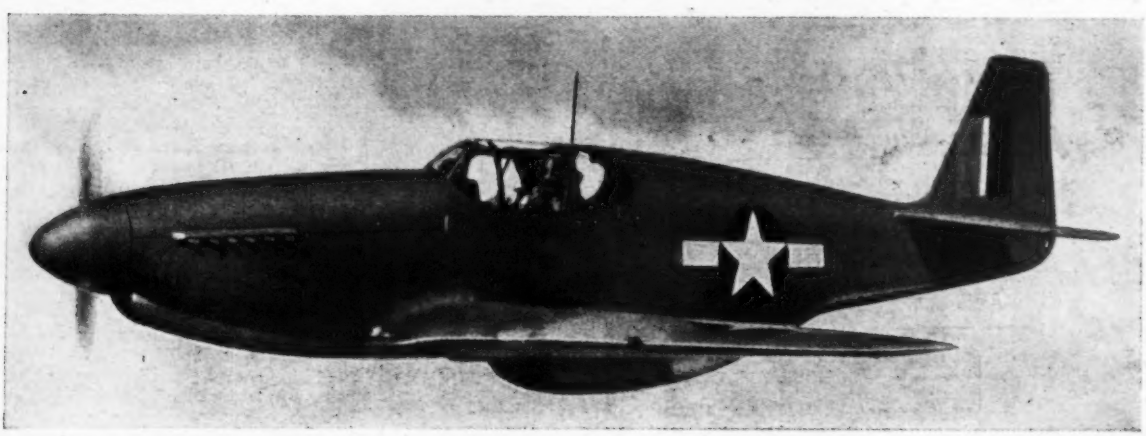
The modifications, intended to facilitate loading and to increase cargo capacity, presumably explain the Washington statement that the first of the 20 new flying boats will be completed "in about a year's time."

The original Mars, which cost about £500,000, is to be used by the U.S. Navy in the Pacific.

China's Aerial Lifeline

MORE military supplies are now reaching China by air from India, over the Himalayas, than went formerly by the Burma Road, it was recently announced.

Operated by the Air Transport Com-



FIRST-LINE FIGHTER : The latest version of the Mustang, the P-51B, is powered by a Packard-built version of the Rolls-Royce Merlin LXI engine with two-stage, two-speed supercharger. Rated at 1,520 h.p., it maintains efficiency at altitudes up to approximately 40,000ft. Note the R.A.F. markings on the fin.

HERE AND THERE

mand of the U.S.A.A.F., a day-and-night service delivers every bomb dropped on the Japs by the U.S. 14th Air Force and the petrol for their aircraft, not to mention all the supplies needed by General Stilwell's forces.

Begun 20 months ago, this military air transport service carried ten times the tonnage in December, 1943, that it delivered in December, 1942. Curtiss Commandos and Liberators are used, and although unarmed, they fly unescorted within range of Jap fighters, and over the 17,000ft. "hump," as the American pilots term their Himalayan route, to China.

Licensed Aircraft Engineers

THE Foundation Committee set up by the meeting on December 15th last held its first meeting on January 5th at the offices of the Royal Aeronautical Society, and decided that two whole days would be devoted to its next meeting in view of the problems to be solved in framing the constitution and the need for urgency. It is hoped at this meeting to fix a date for a general meeting, to which all licensed aircraft engineers (including flight engineers) will be invited through the medium of the Press.

R.Ae.C. International Conference

THE Royal Aero Club, at the suggestion of several Allied countries, has agreed to hold a conference in London to discuss the future international control of flying and air touring.

Invitations have been issued to the representatives of 28 Allied and neutral countries, and the conference will take place at the Royal Aero Club on January 19th, 1944.

Lord Brabazon, president of the Royal Aero Club, will preside.

Canuck Gongs

CANADIANS in the R.A.F. and R.C.A.F. have covered themselves with glory during 1943, having been awarded more than 700 decorations for gallantry. These included 15 D.S.O.s, 450 D.F.C.s, 27 bars to the D.F.C., 210 D.F.M.s, five C.G.M.s and five George Medals.

Incidentally the First Canadian Fighter Wing led all other wings of Fighter Command in the number of enemy aircraft destroyed over a period of several months.

Gallant Exhibit

THE Spitfire II flown by Sqn. Ldr. "Bluey" Truscott, D.F.C. and Bar, the Battle of Britain pilot who lost his life in a crash off the Australian coast last year, is to become a museum exhibit in Australia, it was announced recently by Mr. Arthur Drakeford, the Australian Air Minister.

"Bluey" Truscott, who was a close friend of the equally famous Paddy Finucane, himself bagged 15 German aircraft before he returned to his native Australia to fight against the Japs. He and his "Spit" belonged to the 452nd Australian Squadron, the first R.A.A.F. fighter squadron to be formed in the United Kingdom and one which is still in action.

X-ray Conference

THE third conference on "X-ray Analysis in Industry" has been provisionally fixed for March 31st and April 1st in Oxford. It is being held under the auspices of the X-ray Analysis Group of the Institute of Physics.

Remote Control

AN amusing story of improvisation in the wilds comes from the December *News Letter* issued by B.O.A.C.

When their remote station at Laropi, Uganda, was opened, they managed to acquire a small generator and some wiring to fix up electric light for the staff's quarters, but, since switches proved to be as scarce as bananas in England, the only way to put out the light on retiring was for someone to walk some 50 yards to stop the generator.

Then one man had a brain-wave. He rigged up an auxiliary petrol tank with a small sixpenny oil tin, and just before retiring, the generator plant was switched over to this from the normal tank.

This let the engine run for about 20 minutes, giving everyone nice time to undress and get into bed before it automatically stopped.

Museum Piece

THE Sikorsky VS-300 helicopter, the one with which its designer finally achieved success, has been presented to the Edison Institute at Dearborn, Michigan.

"O.K.! clever puss—*I'll* rivet while you hold up!"

MISCELLANEOUS MISSILES. A 4,000 lb. bomb about to be hoisted into the capacious bay of a Lancaster, with lesser "eggs" and incendiaries waiting their turn.

It will "join other outstanding 'firsts' in aviation in the museum there," says Eugene E. Wilson, vice-chairman and president of United Aircraft Corporation.

Toward 1944 and After

PER A. Norlin, business executive of Swedish A.B. Aerotransport, has made a prolonged stay in the United States, where he has met manufacturers of aircraft and fittings with plans for new stock. He also used the opportunity to discuss possible peacetime air transport co-operation and mutual arrangements with similar American companies.

Mr. Norlin was not 30 years old when, with Capt. Karl Florman, he helped to establish Swedish Air Lines

"Unbelievable!"

OFFICIAL jargon appears to have taken the bit between its teeth while Mr. Churchill has been away. One of the worst recent examples came from the Directorate of Public Relations at the Air Ministry in an embargo on the jet propulsion story. This, it was stated, was "Unpublishable, Unbroadcastable and Untransmissable" before 2200 hours G.M.T., Thursday, January 6th.

One feels tempted to apply to this specimen of Air Ministry English the heading of one of the chapters in Jack London's book, *The Cruise of the Snark* — "Inconceivable and Monstrous."

D

2,200 h.p. Napier

Some Features of a British Engineering Triumph

By F. C. SHEFFIELD

WHEN a Nazi pilot hears the ominous words "Achtung Typhoon" coming over his radio 'phone, he is likely to be somewhat apprehensive. He knows, or has been informed of, the capabilities of the Typhoon and its 2,200 h.p. Napier Sabre engine. He probably wishes the German "back-room boys" had been able to provide him with such a fighting machine, and he would be glad of those additional hundreds of horse-power.

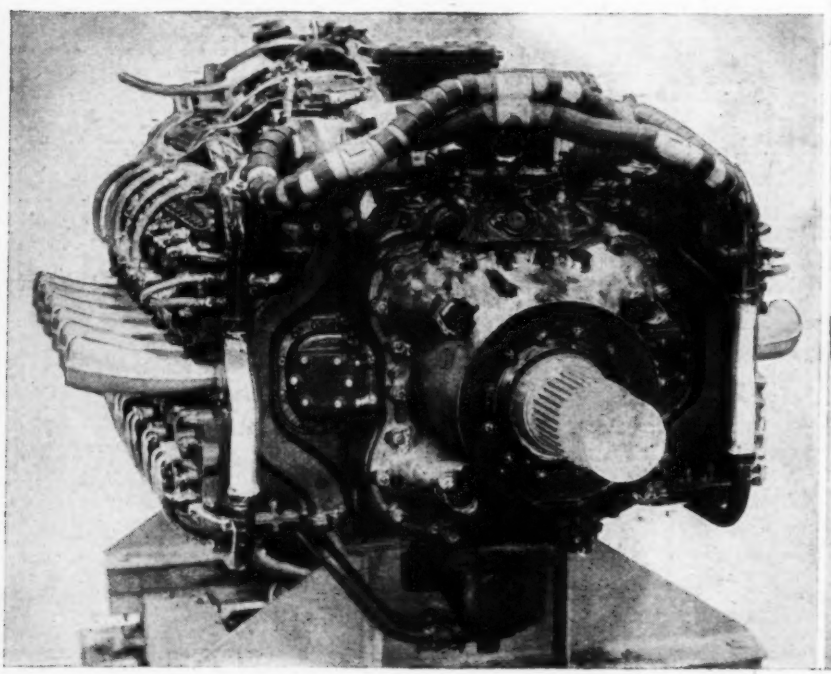
What is it like, this outstanding British engine? Actually it is daringly conceived, brilliantly designed, cleverly constructed and resembles no other engine in production.

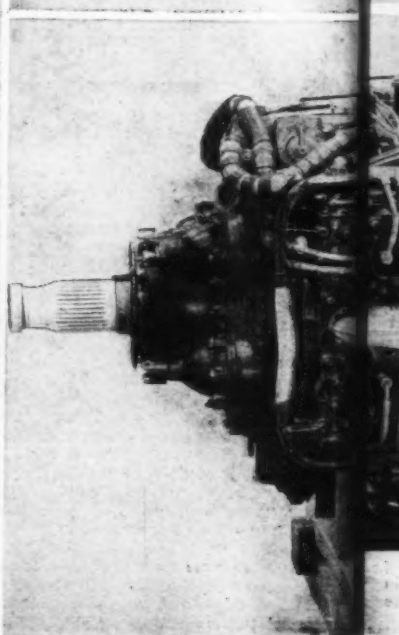
The existence of the Sabre has long been known and has been a subject of much conjecture both at home and abroad, but the design and performance has been kept a closely guarded secret. At present it is operationally employed to power the Typhoon, and, by the courtesy of the Ministry of Aircraft Production, we are now able to give photographs and general particulars.

A Bold Step

It was towards the end of 1935 when the Napier Company first made its decision to proceed with the development of a twin-crankshaft engine producing 2,000 h.p. At that time the largest engines available to aircraft constructors were only of the 1,000/1,200 h.p. class, and it was considered by many to be incautious policy to embark on such a project. Time has amply justified the company's foresight and enterprise.

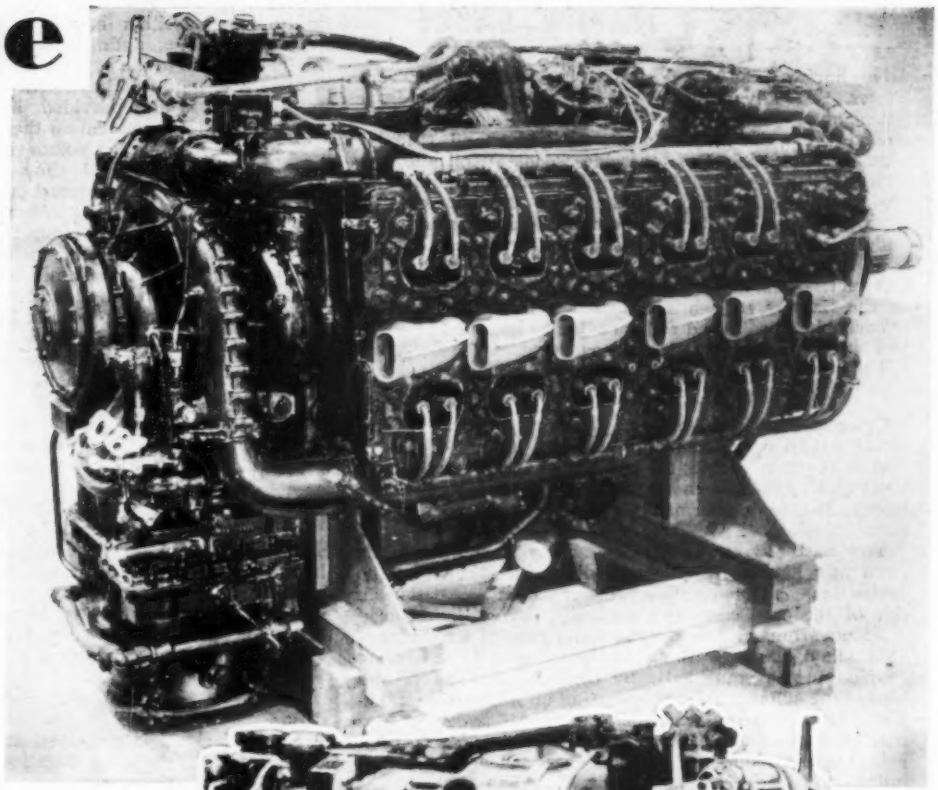
The engine is, of course, a logical successor of earlier Napier twin-crankshaft engines, also designed by Major F. Halford. These, however, were of the vertical "H" type and air-cooled, while the Sabre is arranged horizontally and is liquid-cooled. Another important difference is the discarding of poppet valves for single-sleeve valves. The Sabre is a 24-cylinder, four-stroke, sleeve-





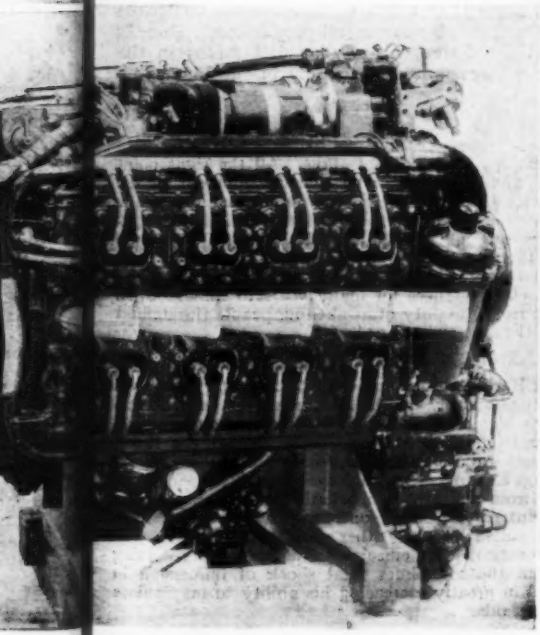
(Below) The nose casing houses double reduction gears from the crankshafts to the airscrew shaft. (Top centre) 2,360 lbs. of closely packed mechanism developing 2,200 brake horse power. (Bottom centre) Plugs, magnetos and distributors are accessible from the sides.

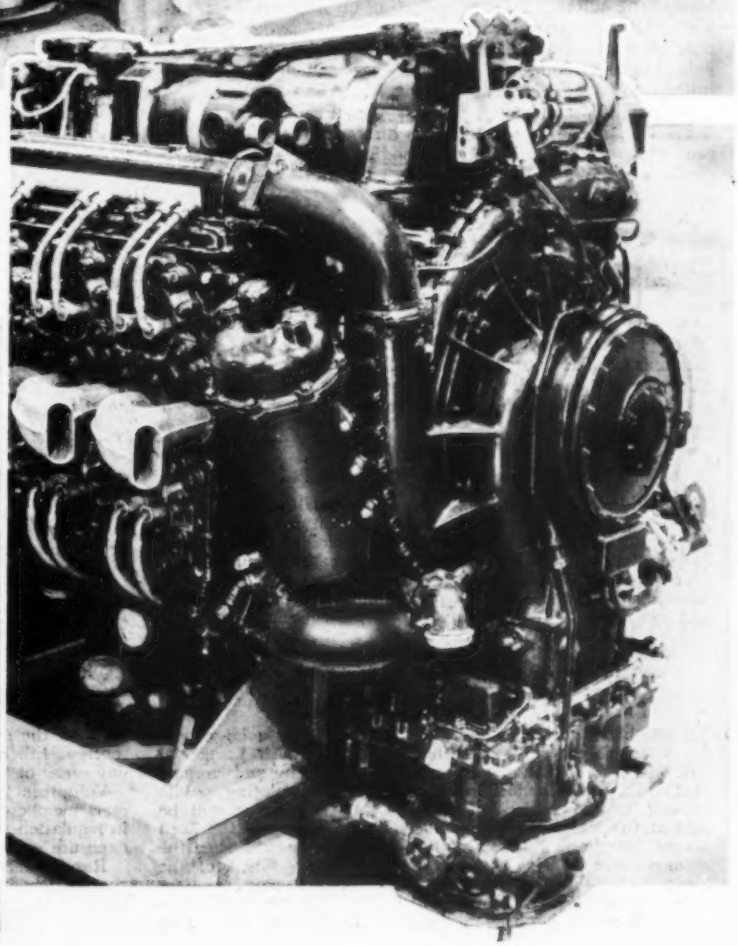
...eSabre



(Top right) Auxiliaries are grouped on top of the crankcase, and fuel, oil and coolant pumps below.

(Bottom right) The double-entry supercharger with its 2-speed clutch. The cylinder on the left is the pressure oil filter.





2,200 h.p. NAPIER SABRE

valve, liquid-cooled engine with a two-speed supercharging blower. The advantages of the general arrangement from the point of view of installation and maintenance will be obvious from the illustrations. All plugs and cylinder heads are accessible from the sides; coolant, oil and fuel pumps are arranged below the engine, and other auxiliaries are grouped on the top. Carburettor and supercharger occupy the usual position at the rear. Four facings on the underside of the crankcase serve as engine mounting feet.

To say the engine bristles with novel features would be incorrect. There are no bristles or trailing appendages on the Sabre. It is a rectangular mass of mechanism, remarkably smooth and compact due to its unique design, and would be better described as being mechanically as full of plums as a pre-war Christmas pudding.

Extremely Compact Unit

Cylinder bore and stroke are 5in. and 4¾in. respectively, giving a total swept volume of 2,240 cu. in. or 36.65 litres. The short stroke enables the width of the engine to be kept down and this factor, in conjunction with the use of sleeve valves, is largely responsible for the compactness of the unit.

Two six-throw crankshafts are arranged one above the other in a light alloy crankcase divided vertically on the centre line. The light alloy cylinder blocks bolted to each side of the crankcase each embody twelve fluid-cooled cylinders arranged in upper and lower rows of six. Shallow light alloy pistons working in the opposed cylinders are coupled to the crankshafts by conventional forked and blade-type connecting rods operating on a common crankpin. At the forward end each crankshaft is geared to a pair of compound reduction gears, and from the front helical-type pinions of these four gears the drive is transmitted to a large diameter helical gear on the airscrew shaft. This arrangement gives a double reduction of the crankshaft speed. The tubular airscrew shaft is on the centre line of the engine and embodies the pressure oil feed ducts for the constant-speed mechanism of the variable pitch airscrew.

The single sleeve valve for each cylinder is of the conventional type operated by a small crank and a ball connection. Double cranks arranged at 180 deg. actuate the sleeves of vertical pairs of cylinders.

Inside the hollow worm shafts are the torsionally resilient shafts which furnish the drive for the medium and high gears of the supercharging blower at the rear end of the crankcase. This component is of the double-entry type. The gear ratio of the supercharged drive is changed by means of opposed conical clutches between which is arranged a double conical male member which is moved hydraulically to engage either the medium or high-speed cone.

The four-choke, updraught S.U. carburettor supplying the fuel mixture to the supercharger incorporates automatic altitude and mixture enrichment controls. An automatic boost control is also provided, but this is arranged as a separate unit and mounted on the supercharger casing.

From the supercharger volute the mixture is fed through four outlets to cast light alloy manifolds, one for each bank of six cylinders. Exhaust ports are arranged between the banks of cylinders, and each pair is fitted with a single ejector nozzle. The efflux from these nozzles results in an improvement in the aircraft performance. The efficient damping of the exhaust flames by means of these ejector nozzles is a characteristic feature of the engine.

Auxiliaries on the upper and lower sides of the crankcase are grouped on crankcase covers and actuated by shafts driven from the reduction gears. Above the engine are two B.T.H. duplex magnetos, two distributors, Heywood air compressor, Pesco vacuum pump, Dowty hydraulic pump, the airscrew constant-speed governor and an electric generator. Below are the coolant pumps, lubricating oil pumps and fuel pumps.

Combustion-type Starter

At the top rear is mounted a Coffman combustion-type starter which drives to the upper crankshaft through the hand-turning gear. At the extreme rear will be noted the cartridge magazine for this unit, which enables five consecutive starts to be effected from the pilot's seat. Lubrication is divided into high-pressure and low-pressure systems. High-pressure oil is fed to the main and big-end bearings and to the reduction gears, whilst the low-pressure system lubricates the sleeve drives and accessory drives.

Ethylene-glycol is employed as coolant, and circulated on a pressure system incorporating a ring-type header tank located around the nose casing and full thermostatic control which by-passes the radiator when the engine is warming up or if the operating temperature falls for any reason.

As long ago as June, 1940, the Sabre passed the Ministry's 100 hours type test with a maximum power output of 2,200 b.h.p. In its present developed form and installed in the Hawker Typhoon, it has a dry weight of 2,360 lb., and produces a maximum of 2,200 b.h.p. at 3,700 r.p.m. At this rating the specific weight per brake horse-power is 1.07 lb., a highly creditable figure for a liquid-cooled unit.

It evokes enthusiasm from maintenance crews, test pilots and combat pilots, and is now in full production. There is no doubt that the Sabre, already a vital factor in the air war, has an important part to play in the impending offensive.

"JETS" ON THE AIR

ON Friday afternoon, following the official release of the news that jet-propelled fighters were in production, Mr. Geoffrey Smith at the invitation of the Canadian Broadcasting Corporation, gave a brief talk on jet propulsion and its implications. This talk, the first on the subject over the radio, was included in the 6.15 p.m. programme, recorded in Canada, and again issued at 7.45 p.m. on the trans-Canada network, which includes some 40 to 50 stations.

A longer talk on the subject by Mr. Smith over the B.B.C. Overseas service was arranged for to-day (Thursday).

AIR LEAGUE MEETING

IN the belief that private enterprise must play a large part in British air transport after the war, the Air League of the British Empire hopes to enlist the sympathy and support of the City of London in its plans for stimulating public interest on the subject of air services. A meeting will be held at the Mansion House, under the presidency of the Lord Mayor (Sir Frank Newson-Smith), on Monday next, when the speakers will be the Duke of Sutherland (President of the League), Lord Bennett and Mr. Theodore Instone.

"The commercial community," says the League, "has been active in examining the possibilities of air transport and in outlining suggestions for its organisation. All the signs point to a period of rapid and comprehensive development in the use of aircraft for ocean, continental, internal and feeder-line travel

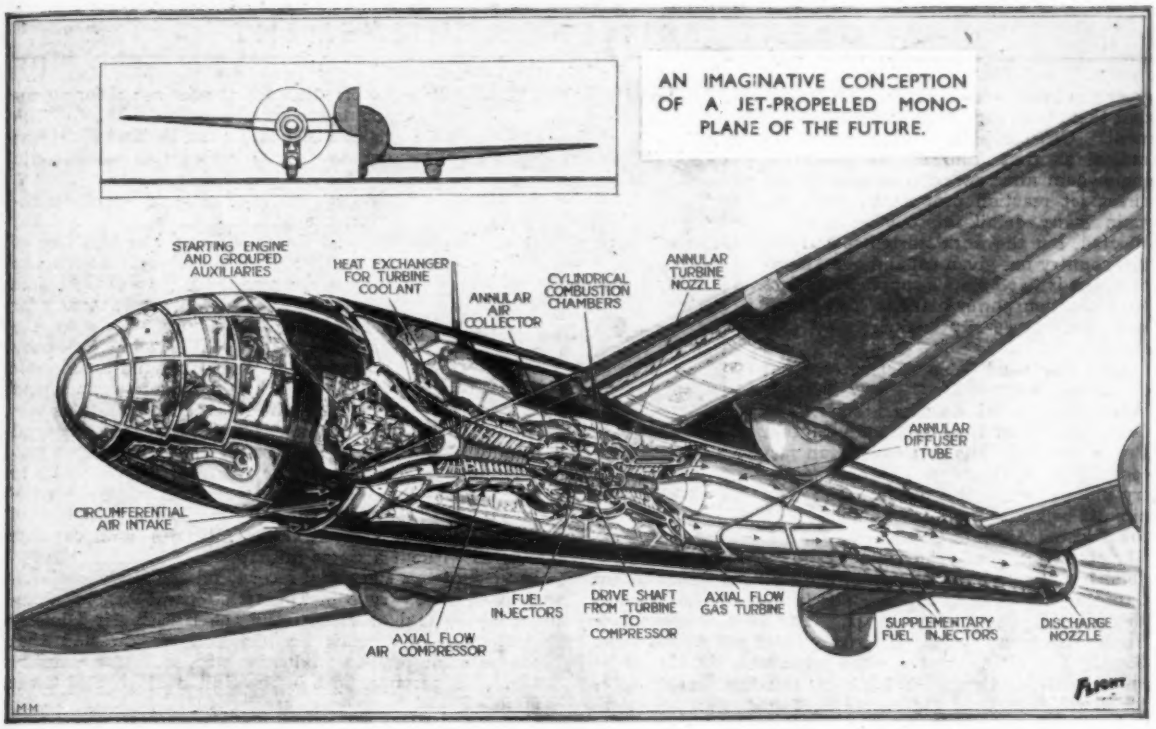
"Most towns throughout the Empire will find themselves involved, and their citizens should be taking an interest now in policies and preparations which will affect their lives and their economic circumstances for many years to come. Upon the Air League rests the duty of awakening people throughout the Empire to their opportunities."

NEW "EXPOSURE SUIT" FOR AIRMEN

A LIGHTWEIGHT waterproof "exposure suit" that will increase immeasurably a ditched airman's chance of survival in the sea is recommended by a joint committee representing U.S. and Canadian Air-Sea Forces, following a three-day series of tests in Canadian Atlantic waters.

Volunteer "guinea pigs" were Royal Canadian Air Force crew members from a nearby embarkation point. Some only in regulation winter flying suits, some with the new lightweight exposure suits pulled on over other garb.

Results demonstrated the efficacy of the suits in protecting the wearer from the sometimes fatal shock of immersion in icy waters, and in greatly increasing his ability to manipulate other life-saving aids.



An example of a plain jet power plant, using the axial type of compressor and turbine.

A Great British Achievement

Jet-propelled Aircraft Have Been Flying Since 1941 : British Pioneers Given Due Credit at Last

"FLIGHT" can justly claim to have given its readers more information about the subject of jet propulsion of aircraft in all its possible forms than any other journal.

From August, 1941, onwards we have published articles and drawings explaining the principles involved and the different solutions of the many problems. In the following is given the history of the Whittle jet-propulsion development from 1937 onwards, including the first test flights made on a Gloster aircraft in 1941.

Group Captain Frank Whittle, the designer of the jet power unit.

THE first British-designed and British-built jet-propelled aircraft made its first test flight in May, 1941. The aircraft was a Gloster machine designed by Mr. W. G. Carter, M.B.E., Gloster's chief designer, and the power plant was a jet-propulsion unit designed by Group Captain Frank Whittle, R.A.F., and built by Power Jets, Ltd. The pilot was Flt. Lt. P. E. G. Sayer, who was killed later in an orthodox aircraft. It was in *Flight* of August 28th, 1941, that we began publication of the series of articles on jet propulsion by G. Geoffrey Smith, Managing Editor, which aroused such world-wide interest that it became necessary to publish the articles, with additions, in the form of a book, "Gas Turbines and Jet Propulsion for Aircraft."

Thus our readers have been kept well informed of what has been done in the way of jet propulsion projects to as full an extent as security considerations permitted. The one thing which we were not allowed to do was to publish the fact that this country was ahead of all others, or even to mention that we were doing any work on jet-propelled aircraft at all. The ban has now been lifted by the joint statement by the U.S. Army Air Force and the Royal Air Force, issued by the U.S. War Department on January 6th. Since those days much development work has been done, and great pro-

A GREAT BRITISH ACHIEVEMENT

gress has been made. That is not to say that there is no further room for improvement. Obviously in a change-over so radical as that from the reciprocating engine-cum airscrew combination to the direct jet reaction propulsion, there remain many detail improvements to be effected, but the work started so early in this country has given us, and our American friends to whom we supplied the first jet-propulsion power plant, a lead which will not be easily reduced by our enemies.

The improved jet-propulsion engines eliminate airscrews on the new aircraft. Work was started on these engines in Great Britain in 1933 by Group Captain Frank Whittle. His first engine ran successfully in April, 1937. The Air Ministry placed their first order in 1939 for an aircraft using jet-propulsion engines with the Gloster Aircraft Company Limited, Gloucester, England; the engines were to be built by Power Jets, Limited, special factory in England, to whom Group Captain Whittle was loaned. The first successful flight of this aircraft was in May, 1941. The pilot was the late Flight Lieutenant P. E. G. Sayer, chief test pilot of the Gloster Aircraft Company. The greatest credit should be given to Group Captain Whittle for this fine performance, for it was his genius and energy that made this possible.

The late Flt. Lt. P. E. G. Sayer who made the first test flight of a jet-propelled aircraft in May, 1941.

Sharing with America

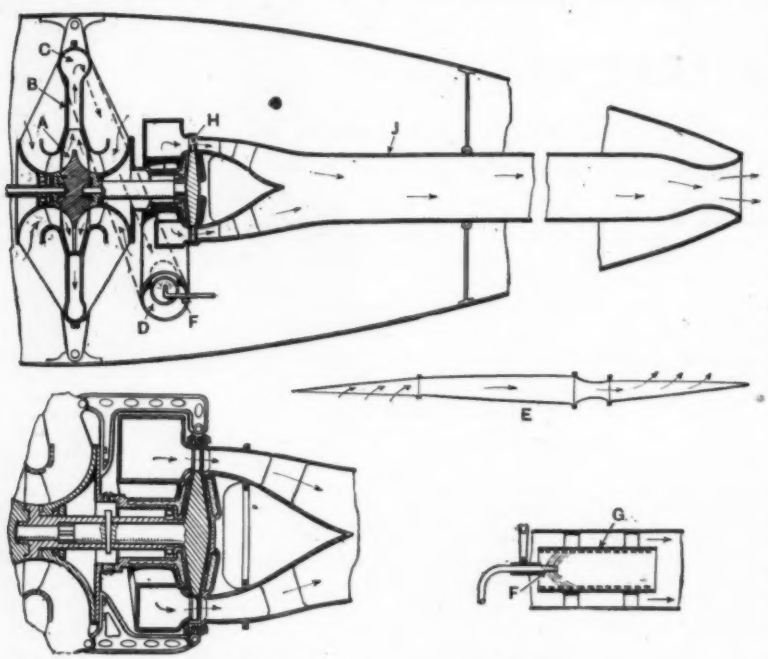
Full information about this jet-propulsion engine was disclosed in July, 1941, to General Arnold, who, like the British R.A.F. and M.A.P., had the foresight to appreciate the tremendous possibilities of this new form of aircraft power unit. He at once asked for an engine to be sent over to U.S.A. The engine which had made the first flight was sent to the American General Electric Company in September, 1941.

As the result of close co-operation between the U.S.A.A.F., R.A.F., A.A.F., Material Command and the Ministry of Aircraft Production and General Electric Company, a number of these engines were built in America. The first was ready for test in less than six months. At the same time the Bell Aircraft Company were given an order to build an aircraft suitable to take two of these engines, and the first flight in the United States was made in under twelve months. Several hundred successful flights have been carried out since then by British pilots in the U.S. and by British pilots with the British aircraft in England, many of them at high altitudes and extreme speed, all without a single mishap.

In view of this successful record and the obvious advantage of this new type of aircraft, General Arnold, Commanding General of A.A.F. and the British Air Ministry and Ministry of Aircraft Production have directed that plans be made for the production of a sufficient quantity for training purposes both in the United States and Great Britain.

The U.S.A.A.F. are allotting a number of these to the U.S. Navy for additional trials and experimentation. The maiden flight of the first experimental aircraft in U.S.A. took place on October 1st, 1942. This was the first successful operation of a combat plane using the jet-propulsion principle. Robert M. Stanley, chief test pilot of the Bell Aircraft Company, was at the controls on the initial flight. The next day Brigadier-General (then Colonel) Lawrence C. D. Craigie flew the aircraft, thus becoming the first Army officer to fly a jet-propelled military aircraft in the United States. Among others who have tested the new aircraft are Brigadier B. W. Chidlaw, Chief of the Material Division, Office of Movement Control; Chief of Air Staff Material Maintenance and Distribution, and Major-General William E. Kepner, an Air Corps fighter pilot formerly commanding 4th A.F.

In the United Kingdom the J.P. aircraft has been flown by a number of test pilots of aircraft firms and R.A.F. officers.



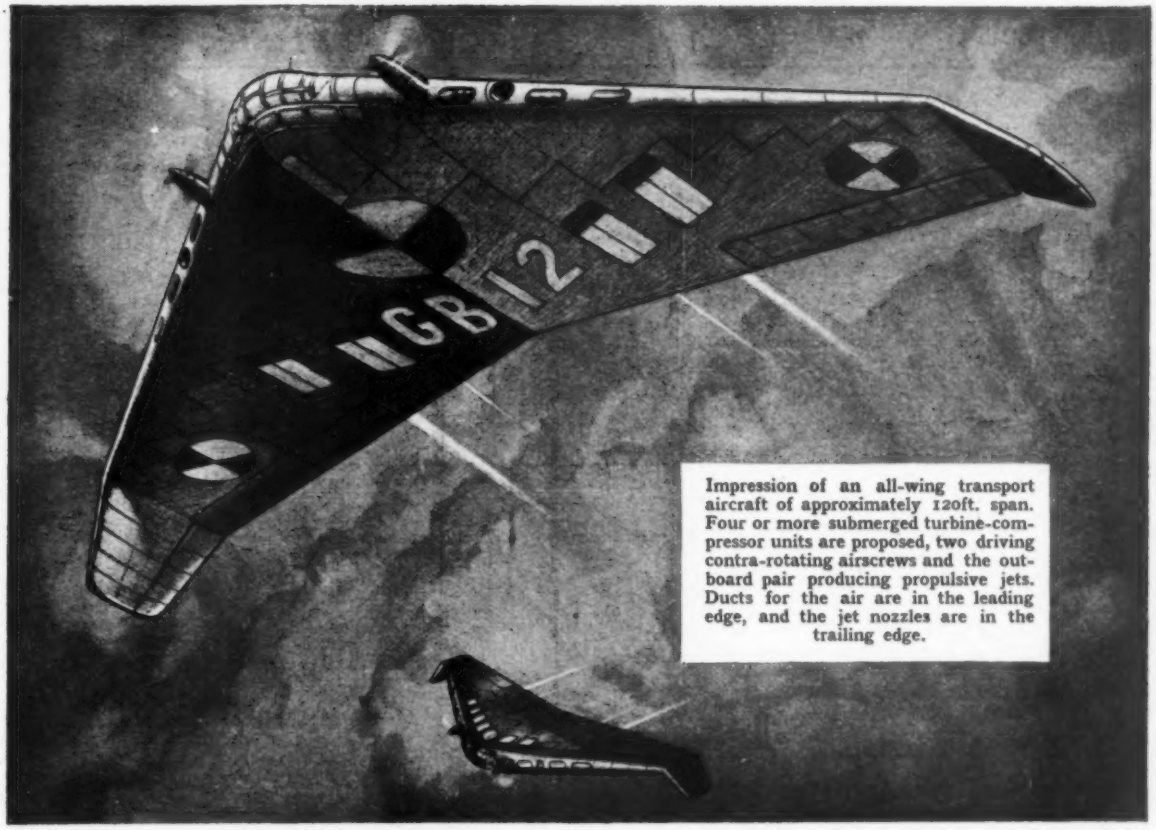
A. Compressor impeller.
B. Primary diffusion chamber.
C. Air delivery scroll.
D. Helical combustion chamber.
E. Plane development illustrating gas flow.
F. Fuel injector.
G. Combustion cowl.
H. Turbine rotor.
J. Discharge conduit.

Whittle design for a turbine-compressor jet propulsion plant.
(From "Gas Turbines and Jet Propulsion for Aircraft.")

The Designer

Group Captain Frank Whittle is the inventor of the first successful jet-propulsion engine for fighter aircraft. His first engine ran successfully in 1937, when he was placed on the Special Duty List for research work. Group Captain Whittle has been engaged in perfecting his invention through all its stages—except for a period at the R.A.F. Staff College in 1943—whilst on loan to Power Jets, Ltd., in a special factory in England.

He was born at Coventry on June 1st, 1907, and was educated at Leamington College, leaving there in 1923 to become a Royal Air Force appren-



Impression of an all-wing transport aircraft of approximately 120ft. span. Four or more submerged turbine-compressor units are proposed, two driving contra-rotating airscrews and the outboard pair producing propulsive jets. Ducts for the air are in the leading edge, and the jet nozzles are in the trailing edge.

tice. While an apprentice he made a number of remarkable model aircraft, and at the end of his apprenticeship was awarded a cadetship.

From 1926 to 1928 he was a flight cadet at Cranwell, and at the end of his course he gained the Abdy-Gerrard-Fellowes Memorial Prize for aeronautical sciences.

After leaving Cranwell in 1928 he became a Pilot Officer in No. 111 Fighter Squadron, and at the end of 1929 he took the instructors' course at the Central Flying School. During this period he began to work on his jet-propulsion ideas.

Promotion to Flying Officer took place in January, 1930, and in the same year he became a flying instructor at No. 2 Flying Training School, Digby. It was during this period that, with the late Flying Officer G. E. Campbell, he gave one of the most thrilling exhibitions of crazy flying at the Royal Air Force Display at Hendon.

He next became an experimental test pilot on float seaplanes at Felixstowe during 1931-2, specialising in catapult work. Following this, he went to Henlow on the Officers' Engineering Course, 1932-3, being promoted to Flight Lieutenant in January, 1934.

At Cambridge

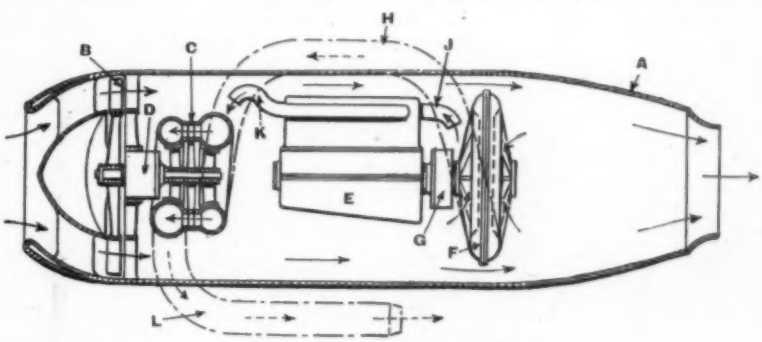
He then spent three years at Cambridge University, obtaining a First Class Honours Mechanical Science Tripos in 1936, followed by a year's post-graduate work at Cambridge, during which he was associated with Professor Sir Melvill Jones. He became a Squadron Leader in December, 1937, Wing Commander in June, 1940, and Group Captain on July 1st, 1943.

Group Captain Whittle married in 1930, and has two sons, aged 12 and nine years.

Testing the First Machine

"One of the finest test pilots in the country," was the description applied to Phillip Edward Gerald Sayer at the time of his death on October 22nd, 1942.

He was born on February 2nd, 1905, and was educated at Colchester Grammar School, obtaining a short-service commission in the Royal Air Force in June, 1924. After learning to fly in an Avro 504K, he flew Snipes and Gladia-



A. Main duct.
B. Axial-flow compressor.
C. Gas turbine.
D. Reduction gear.
E. Compression-ignition reciprocating engine.
F. Centrifugal compressor.
G. Increasing gear.
H. Air duct from centrifugal blower to turbine.
J. Engine charging air pipe from duct H.
K. Engine exhaust pipe to duct H.
L. Turbine effluent pipe for supplementary propulsion.

The Whittle "dual thermal cycle" scheme employs a diesel engine and a compressor to supply air and combustion products as the working medium to the turbine which drives the main compressor.

A GREAT BRITISH ACHIEVEMENT

tors, his outstanding qualities as a pilot resulting in an appointment as test pilot at Martlesham Heath.

Flight Lieutenant Sayer left the R.A.F. on the completion of his five-year commission to join the Hawker Company, and was appointed as assistant to Group Captain P. W. S. Bulman. Here he was engaged in testing Harts, Furies, and other aircraft, and on the acquisition of the Gloster Aircraft Company by the Hawker Group, was appointed in 1935 chief test pilot of the Gloster Company.

He has been described as a typical British test pilot, modest to a degree and disinclined to talk about his work. A tribute paid to him by Mr. Michael Daunt, one of his assistant test pilots, stated:

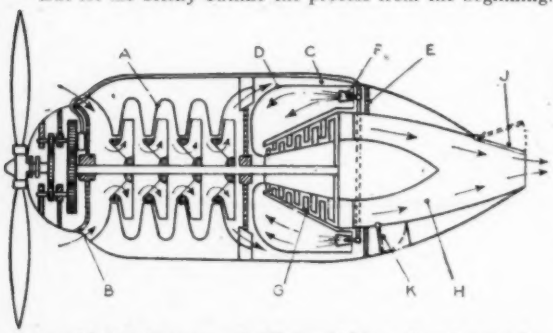
"I have worked with 'Jerry' for five-and-a-half years, and although he was virtually my boss he was the type of boss who was so much more a personal friend that one did every job of work as a piece of co-operation. As a test pilot he was one of the foremost in the country. He had a terrific ability of being able to fly extremely well and smoothly, but he had also the type of orderly brain that never misses a detail. When he landed after an important test, the information he gave would always be of value to the future of that aeroplane and of help to its designer."

Canadian Broadcast

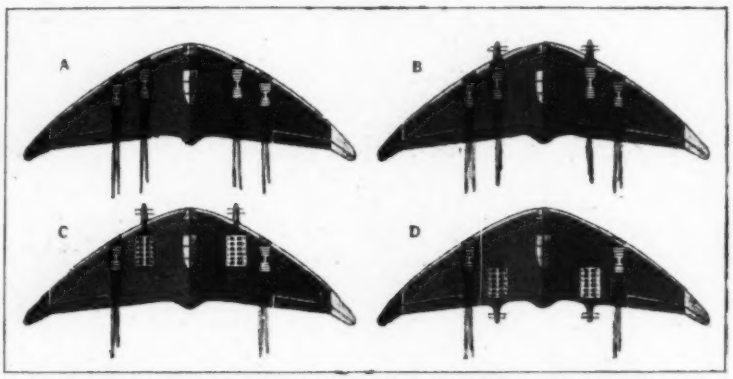
On Friday afternoon last the Canadian Broadcasting Corporation arranged a brief talk by Mr. Geoffrey Smith over the trans-Canada network on the subject of jet-propelled aircraft. This is the text:—

"To-day one of the biggest secrets of the war in connection with aircraft was divulged by the Royal Air Force and the United States Army Air Corps. I refer to the disclosure that jet-propelled aircraft had been successfully flown and are now in production as fighters. To the man in the street the term jet propulsion will be somewhat mystifying, and a few words of simple explanation may serve to enlighten those interested in engineering progress. And let me here say that this new power unit is of a revolutionary character and we owe it to a brilliant young British engineer-pilot in the R.A.F., Frank Whittle, who was promoted Group Captain a few months ago. In the case of jet-propelled aircraft the power unit consists essentially of an air compressor driven by a combustion gas turbine (not a steam turbine). This combined unit produces a stream of air and gas which is ejected at high velocity through a nozzle in the tail of the aircraft. The rearward thrust of this jet of heated air creates an opposite reactive thrust on the machine and propels it forward.

"But let me briefly outline the process from the beginning.



A combined airscrew and jet-propulsion unit. A, centrifugal compressor; B, air inlets; C, annular air duct; D, mixing chamber; E, bulkhead; F, fuel nozzles; G, gas turbine; H, discharge duct; J, discharge flap; K, effluent by-pass flap.



Four suggested arrangements of power units on all-wing aircraft. A has four continuous-combustion turbine and axial compressor-type jet-propulsion units. B has two turbine-driven contra-rotating airscrews and two jet-propulsion units. In C two reciprocating engines drive contra-rotating airscrews, and there are two jet-propulsion units. D has the same power units, but airscrew pushers.

The working medium is air drawn from the atmosphere, compressed and passed into a combustion chamber. Here liquid fuel is sprayed in and continuously burned in order to heat and expand the air. From the combustion chamber this hot gas mixture expands through the turbine, thus imparting energy which is utilised to drive the compressor. Both the turbine and the compressor are on a common shaft and rotate at extremely high speed—certainly in excess of 10,000 r.p.m., but speed, of course, depends upon the size of the turbine adopted.

From the turbine the gas/air stream is discharged to atmosphere as a high-velocity jet through the tail nozzle previously referred to. It seems fantastic that any aircraft propelled by reaction of a jet of air in this manner can improve upon existing performance and, at the same time, eliminate a great deal of complication in the power unit. What is amazing to those who have not studied the subject is that this revolutionary unit at certain altitudes makes possible a speed higher than has been attained up to the present with orthodox types of aircraft engines. In the upper atmosphere this particular form of turbine combination revels in its work. You may ask: 'What are the further advantages of jet propulsion now so enthusiastically appraised by Britain and America?' Here are some points: Apart from the elimination of the airscrew, which tended to become a limiting factor in ordinary engine development, the turbine compressor unit is of extremely convenient shape for installation. Rotary components are used exclusively and this, coupled with the high speeds attained, provides extremely smooth operation. The absence of an airscrew enables the aircraft to be of exceptionally low build, as obviously there is no need of ground clearance for the rotating blades. No transmission or conversion mechanism is required so that cost, complication and man-hours in production are very much reduced with jet propulsion plants.

"To some Canadians this idea of jet propulsion is not entirely new. Some years ago, having recognised the great promise of this new form of power unit, I wrote many articles on the subject, which were later published in book form. Copies found their way to my son, a Squadron Leader in the R.A.F. instructing in Canada at Bowden, Kingston and elsewhere, and he, too, became imbued with the enthusiasm I had exhibited for early projects in jet propulsion systems, and lectured on one or two occasions on the subject.

"Following upon Group Captain Whittle's enterprise in perfecting jet propulsion plant over a period of years, it is good to know that the United States Army Air Corps at once recognised its potentialities and requested a sample, which was sent to the G.E.C. Company in the U.S.A. The two Allies are now working in close co-operation and one can be sure that their joint efforts will result in big new technical and operational developments in the not distant future. Many of us feel that in the turbine-compressor unit we have a strong competitor to the reciprocating engine, at least for certain services, and the adoption of such units will revolutionise the design of aircraft of the immediate future, and in the air transport world of the days of peace. It is pleasing that this pioneer work can be credited to British enterprise."

Weight Estimating

Some Suggestions for Improving the Standard of Early Design Estimates

By L. W. ROSENTHAL, A.F.R.Ae.S.

THE business of weight estimating, which goes hand-in-hand with all aircraft design, structural and aerodynamic, rarely if ever receives the attention with its importance merits. Many otherwise good aircraft have been marred by poor payload or bad take-off, due solely to bad weight estimating; and not a few designers have received shocks through bad balance estimates made in the early stages of design.

The first essential for good project estimating is a realistic outlook. Too many tender weight estimates are nothing but flights of fancy, particularly on military aircraft, where contracts contain no financial penalty clause.

It is true that project work needs vision, and confidence in one's ability to improve on existing material, but this should not be allowed to obscure practical realities. For instance, if the structure weight percentage of a certain type of aircraft averages, say, 35 per cent. on all models produced during the last three or four years, it is very unlikely that anything more than 1 per cent. can be cut from this figure on a new design. Revolutionary design may suggest more saving than this, but no statistical analyses exist for revolutionary designs.

Statistics suggest that improvement is very slow indeed. New materials should make for lighter weights, but generally speaking such improvements have, in the past, been absorbed by additional aerodynamic improvements such as flaps and retractable undercarriages. Though these items result in a more efficient aircraft, structure weight percentage tends to remain the same.

On large aircraft the scale law has been thwarted to a certain extent by improvements in materials, more efficient structures, and by reductions in factor. Whilst, with materials and structures, further improvement can be reasonably anticipated, factors seem to have reached a point where no further reduction is likely. In view of this, we can expect small improvement in the structure weight percentage of large aircraft (100,000 lb. and up), indeed, it may even be found that structure weights may increase.

Overdoing It?

Our American friends with their quicker reaction to such matters have tackled the weight problem in a big way; in fact, the numbers of weights personnel employed by some American companies lead one to suspect that they have tackled it in too big a way. Approximately 4 per cent. of their technical staffs are employed on weights, and when it is realised that their technical or engineering staffs include jig and tool, processing and production departments, it will be seen that the amount of personnel devoted to weights is considerably in excess of the "one-man-and-a-boy" outlook which appears common in Great Britain.

The American Society of Aeronautical Weight Engineers is a result of the importance which the weight engineers of the U.S.A. attach to themselves, and since it receives the backing of the American aviation industry one can reasonably conclude that this important branch of aircraft design is now receiving the attention it deserves.

It is difficult, at the moment, to say whether the vast organisation and expenditure in the United States has produced lighter aircraft than contemporary British practice, but recent experience in other fields convinces one that "muddling through" will produce small dividends in the future.

The collection and analysis of weight data should be the primary employment of a senior member of the weights staff in all companies. Whilst particular attention will obviously be paid to the type of aircraft in which the company normally specialises, other types should not be neglected, since these not infrequently provide useful "pointers," and enable one to interpolate graphs, etc., beyond the range of immediate actual knowledge.

A weight handbook for the use of the project department should be compiled from the analysed statistics, and should include sections covering all the major airframe components. Separate sections should cover power plants and equipment. This latter item is by no means unimportant, since few persons are aware of the magnitude of the increase which has taken place in such items as radio and instruments, to quote but two examples. The compilation of this handbook, and its constant revision, for it is essential that it be maintained completely up to date, together with the collection of data, will, in all probability, provide full-time employment for the weight engineer concerned.

All weights, from whatever sources gleaned, no matter how insignificant, should be recorded. While much of this may for ever remain unused, it is surprising how often little items, apparently of no account at the time of recording, help to fill in the missing points on a curve, or assist in establishing a hitherto unnoticed trend in design. It is always wise to record also the source of information, as this is invaluable in assessing the standard of accuracy.

Collection of Data

The collection of all relevant data goes hand in hand with the collection of weights, and such information as spans, areas, volumes, capacities, horse-powers, etc., should be meticulously collected. In view of the very excellent reference books now available, this may appear superfluous, but it will usually be found that the very information required to clear up a particular point is not given in any volume at hand. It follows that, if this collection of data is to be at all comprehensive, the person responsible must be given access to, and facility for studying all reports, journals, etc., in which information is likely to be found. Further, any information gathered in the course of business contacts by other employees should be passed on to him.

Mutual contacts between the weights personnel of various companies will lead to a greater amount of material becoming available to all. This suggestion may not meet with favour from all chief designers. It is essential, however, that the weights engineer concerned should be a discreet person, unlikely to disclose any immediate company secret, and, since this is a responsible job, will be a person in whom the chief designer can place his confidence.

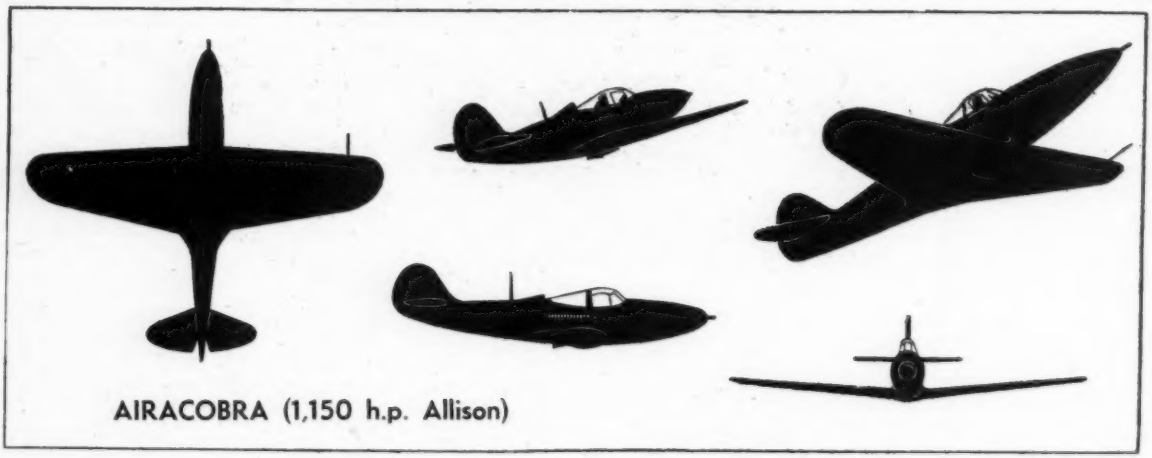
The Americans have again shown us the lead in this matter. The American aviation industry's backing of the Society of Aeronautical Weight Engineers has enabled this body to embark upon the project of collecting from a number of companies their project weight-estimating data for translation into a weight handbook for circulation to all the participating companies.

Careful tabulation of the project estimates, early scheme estimates, drawing estimates, and final weighed weights should be made for all types. These weights for all components should be broken down into sub-components, i.e., spars (booms and braces), ribs, frames, sheeting, etc. Whilst this process, in a firm designing and building large aircraft, may be spread over some time, it may be almost years, the information of one aircraft alone will prove of considerable value when new designs reach the scheme stage. (The writer envisages this as the stage between the project and the manufacturing drawings.)

Careful and intelligent interpretation of an analysis as suggested above should lead to better and more accurate estimating at all stages of design. When figures for several designs have been collected, the improvement in estimating at all stages will be easily calculated, and, with patient application, this method should lead to a very high standard of weight estimating.

Studies in Recognition

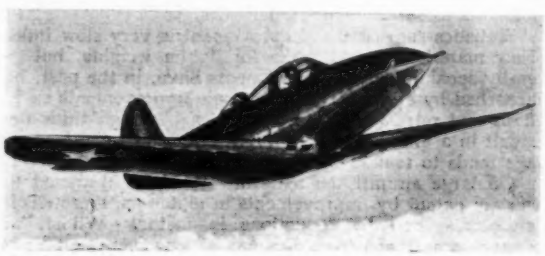
Aircraft in F



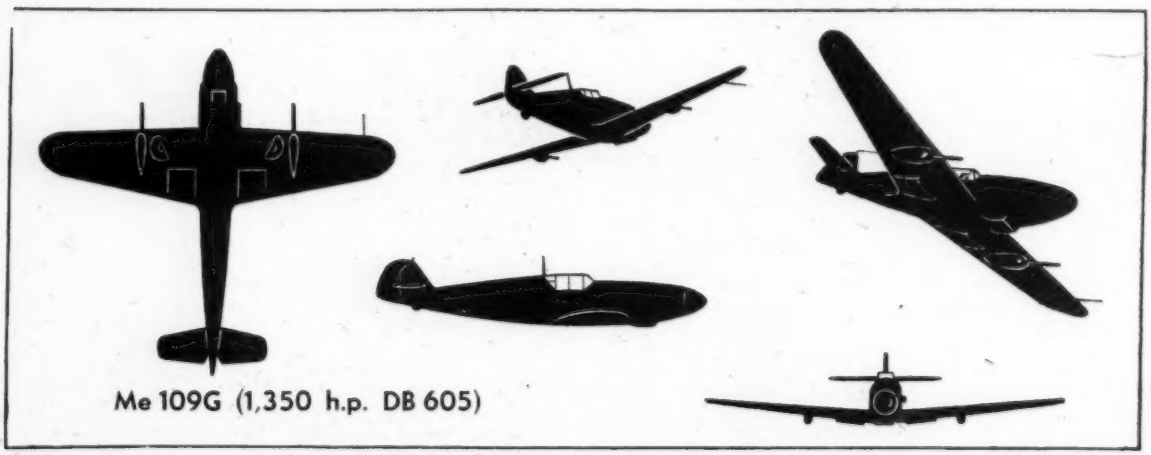
AIRACOBRA (1,150 h.p. Allison)

NOTABLE for its unusual design in having the engine behind the pilot amidships and tricycle undercarriage, the Airacobra has particularly clean lines. But its single-speed, single-stage supercharger is inadequate for performance at altitude and it is thus only efficient up to about 15,000ft. Top speed is 370 m.p.h. and armament consists of a 20 mm. or 37 mm. cannon, two 0.5in., and four .303in machine-guns.

A two-seater trainer version has recently been developed but the present fighter is to be supplanted by a new model with two-stage supercharger. Recognition points include long nose, air-intake behind streamlined cabin top and smoothly curved underside of oval fuselage; wings taper to round tips, small rounded fin and rudder, " wing-nut " tailplane. Dimensions:—Span 34ft., length 29ft. 9in., height 9ft. 3in., wing area 213 sq. ft.



Bell Airacobra Single-seater Fighter.



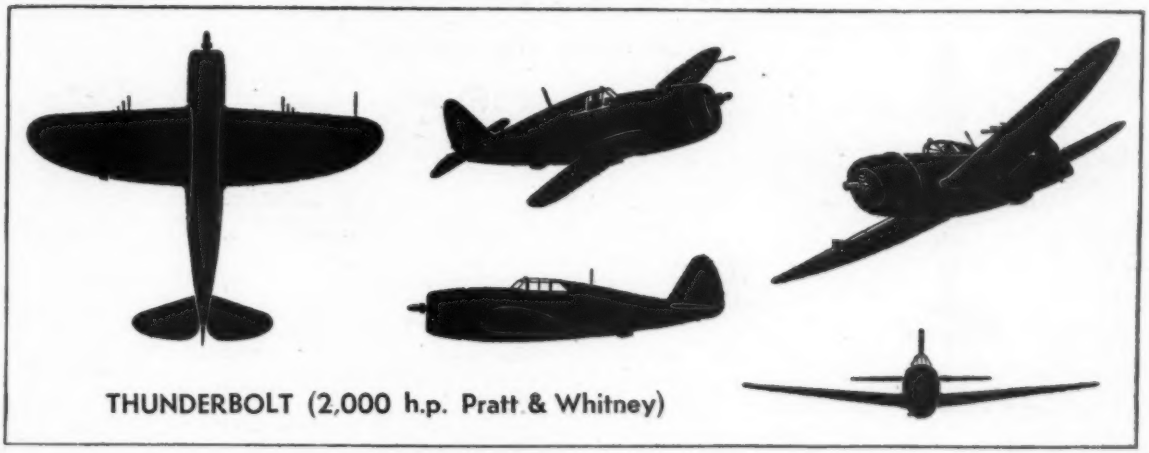
Me 109G (1,350 h.p. DB 605)

Messerschmitt Me 109G Single-seater Fighter.

HIGH-ALTITUDE development in the Messerschmitt Me 109 series of single-seater fighters, the 109G mainly differs from its predecessor, the 109F, in having the Daimler-Benz D.B. 605 engine which develops approximately 1,350 h.p. at 18,500ft. Its main armament comprises a 20 mm. cannon firing through the spinner, and two 7.9 mm. or 13 mm. machine-guns firing through the airscrew arc, as on the 109F, but, in addition, it has a pair of 20 mm. cannon mounted in fairings under the wings. Some versions are known to be fitted with a pressure cabin. Top speed is about 400 m.p.h.

Recognition points, as for the 109F, include tapered wings with round tips, prominent supercharger air-intake on port side above exhaust outlets, a shallow radiator under each wing, and typical Me 109 tail unit. Dimensions:—Span 32ft. 6in., length 29ft. 7in., height 8ft. 5in., wing area 173 sq. ft.

ing Attitudes

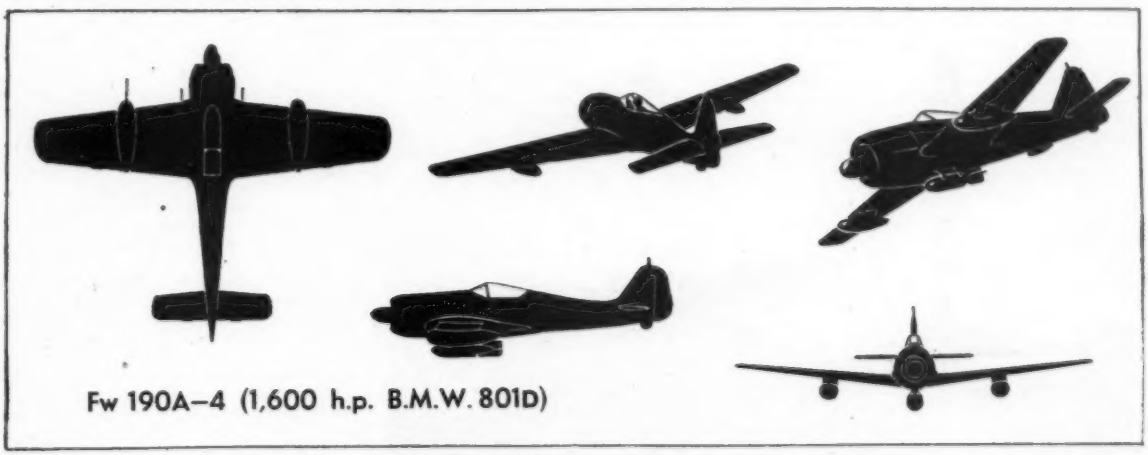


THUNDERBOLT (2,000 h.p. Pratt & Whitney)

Republic Thunderbolt (P-47B) Single-seater Fighter.

KNOWN in the U.S.A.A.F. as the P-47B, the Republic Thunderbolt is probably the largest and heaviest single-seater fighter in the service of the Allies to-day, its loaded weight being no less than 14,000 lb. Recently a fighter bomber version has been introduced.

Powered by an 18-cylinder, 2,000 h.p. turbo-supercharged Pratt and Whitney " Double Wasp " engine, the Thunderbolt fighter has a top speed of more than 400 m.p.h. and good altitude performance. It is well protected and its armament consists of eight 0.5in. machine-guns in the wings. Recognition points include deep oval fuselage and cowling, low wings with straight, slightly backswept leading edge and curved trailing edge, large " wing nut " tailplane, and almost triangular fin and rudder. Dimensions:—Span 40ft. 9in., length 36ft. 11in., height 13ft., wing area 270 sq. ft.



Fw 190A—4 (1,600 h.p. B.M.W. 801D)

GERMANY'S most efficient single-seater fighter, the Focke-Wulf Fw 190, powered by the 1,600 h.p. 14-cylinder B.M.W. 801D radial engine, is also in service as a long-range fighter-bomber with wing drop-tanks. Its compact power-unit is notable for the low-drag cowling which encloses a 12-bladed fan to assist the cooling. Behind this the fuselage tapers in straight lines to the tail, imparting that carrot-like outline in plan which is a notable recognition characteristic of this aircraft. The wings, which taper more on the trailing edge, are set well forward and have bluntly rounded tips, and the high aspect-ratio tailplane is almost rectangular.

Its armament consists of two synchronised 7.9 mm. machine-guns in the fuselage and four 20 mm. cannon in the wings. Top speed is 385 m.p.h. at 19,000ft. Dimensions:—Span 34ft. 5in., length 29ft. 11in., height 12ft., wing area 203 sq. ft.

Focke-Wulf Fw 190A-4 Single-seater Fighter-bomber.

Behind the Lines

Service and Industrial News from the Inside of Axis and Enemy-occupied Countries

Bulgarian Chief

GEN. AYRANOV, C.-in-C. of the Bulgarian Air Force, presented special medals to relatives of Bulgarian pilots killed during the raid on Sofia.

Fuel Reduction

GERMAN petrol exports to Denmark have greatly decreased, reports the Danish Press Service, quoted by *Reuter*. It is believed that this drop is due to the destruction of about 50,000 tons of aviation spirit during one of the recent air attacks.

Odour

GERMAN experts are said to have found that the scent of flowers such as lily-of-the-valley is upsetting to airmen. Not only is the perfume of this flower likely to cause an airman's nerves to become ruffled during enemy engagements, but the poisonous nature of the bloom is said to impair the vision of airmen when at an altitude of 1,000 ft. or more, according to "Message," the Belgian publication. The chrysanthemum is another bloom that is discouraged among German airmen. When on leave Nazi airmen mostly remove these flowers from the rooms where they are likely to remain for some time.

It is pointed out that even in a country like Japan, where chrysanthemums are idolised in many ways, Japanese airmen cannot make full use of their powers of observation and endurance when inhaling the odour of the blooms. And German flyers are more noticeably affected in this way.

On the other hand, the smell of common garden mint actually helps Nazi flyers to endure fatiguing flights and to remain cool under adverse circumstances, and is soothing to the nerves when in actual flight, taking off or landing. Other flowers which are said to exert a bad influence are narcissi, roses, tulips, hollyhocks and geraniums.

Report on Hungary

LAJOS CSATAY, the Minister of Defence, gave this statement in the Hungarian Upper House on his country's defence preparations: "The youngest branches of national defence—air and A.A. defence—are being considerably developed. Private and public shelters are being built at high speed. The implements necessary for the water supply are being produced, and the A.A. observer service and armament industry are developing favourably. The air defence of towns has been reorganised and the number and effectiveness of A.A. guns has also been increased."

In contrast to the line of propaganda taken recently by official Hungarian spokesmen and the Press attempting to minimise Hungary's contribution to Germany's war production, the Minister said that the Hungarian Government attaches great importance to the complete modernisation of the armament industry, which is developing favourably.

He also acknowledged the co-operation with Germany, saying that while Hungary created an aircraft industry corresponding to the working capacity of the country, aircraft production in Hungary is by no means self-supporting and progress has been achieved only because of the aid of the German industry.

Concluding, Csatay said that he regards the swiftest possible creation of a modern air force as one of the most important problems of his country.

An armoured train in service with the Finnish A.A. artillery. The train is equipped with a 40 mm. A.A. gun, Bofors L/60.

Who's Who

FROM neutral sources it is revealed that the name of the O.C. of the Croat Air Force, a satellite of the *Luftwaffe*, is Col. Roculja.

Debut

ACCORDING to an announcement by Mussolini's Under-Secretariat for Air, the recreated Fascist Italian Air Force went into action for the first time to intercept Allied aircraft during a recent raid on Turin.

No Witchcraft

"RUMOURS about a German secret weapon, such as new types of rockets, lack, in all probability, any foundation," said a German military commentator.

This statement, probably designed to confuse Allied intelligence and to prevent Germans from placing their confidence in a single weapon and to assert that the initiative is still with the Germans, goes on to predict that the new phase of the war will be quite different from anything experienced hitherto. It will be the result of 100 per cent. total war which was ordered by the German leaders a year ago.

"The German High Command will not have to resort to secret weapons," concluded the commentator. "It will not be witchcraft which will lead Germany to victory, but the new offensives which will be based on sheer organising power."

Inside Germany

"THE evacuees are not gipsies but Germans," proclaims a German newspaper. The train-loads of evacuees do not always find a brotherly welcome from their hosts. Apart from the usual lack of understanding between town and country folk, the bulk of evacuees go to places where there is little love for Prussians. "It must not happen again," says a German writer, "that women and small children return to the threatened towns because they are treated so harshly and tactlessly."

Another German commentator gives this picture of how the bomber slashes the Nazi home front: "The manifold difficulties created by bombing should not be concealed," he says. "Economically one has to think only of the consequences of the destructions of railway stations and telephone exchanges to gauge under what difficulties work must go on in transport and communications alone. How much time, labour and material are needed for the removal of factories from the threatened regions!"

Such tribute to the bomber is not astonishing: German propaganda has travelled a long way since Hitler laid down the rule that the biggest lie is the best.

After Stalingrad it appealed to the emotional, the mystical and the heroic. But its stock is running low. On the eve of the New Year it attempts to brace up the German to new efforts by taking the line of semi-realism, by revealing half truths.

New Year Honours

Decorations for Captains of Civil Aircraft and Members of the Industry : Dominions Lists

(*Continued from page 17, January 6th, 1944.*)

AIR FORCE CROSS

F/O. E. A. Ayres, R.A.F.V.R.; F/O. P. T. Buckingham, R.A.F.V.R.; F/O. A. R. Burchett, R.A.F.; F/O. W. F. Caldow, D.F.M., R.A.F.V.R.; F/O. P. Drummond, R.A.F.V.R.; F/O. A. Dunhill, R.A.F.; F/O. W. A. M. Dunjey, R.A.F.

F/O. A. P. Goodman, R.A.F.V.R.; F/O. E. B. Graham, R.C.A.F.; F/O. A. F. Green, R.C.A.F.; F/O. E. J. Hale, R.A.F.; F/O. P. J. Hillman, R.A.F.V.R.; F/O. H. P. Lee-Warner, R.A.F.V.R.; F/O. D. W. Newton, R.A.F.V.R.; F/O. H. L. Pewtress, R.A.F.V.R.; F/O. D. Robb, R.C.A.F.; F/O. S. Robinson, R.A.F.V.R.; F/O. C. R. Turner, R.A.F.V.R.; F/O. D. A. Wright, R.A.F.V.R.; P/O. A. S. Morton, R.A.F.; P/O. G. R. Wheeldon, R.A.F.; W/O. J. McPhee, R.A.F.V.R.; W/O. H. W. Player, R.N.Z.A.F.; W/O. C. E. Williams, R.A.F.V.R.; W/O. A. E. Maxwell, R.A.F.V.R.

AIR FORCE MEDAL

W/O. C. Beveridge, R.A.F.; Flt. Sgt. W. G. Gregory, R.A.F.V.R.; Flt. Sgt. P. J. Hughes, R.A.F.; Flt. Sgt. G. F. Inman, R.A.F.V.R.; Flt. Sgt. R. Leech, R.A.F.V.R.; W/O. P. J. Legros, R.C.A.F.; Flt. Sgt. H. Orme, R.A.F.V.R.; Flt. Sgt. J. I. Parry, R.A.F.; Flt. Sgt. W. L. E. Pestell, R.A.F.; Flt. Egt. E. Preston, R.A.F.V.R.; Flt. Sgt. M. Rowlands, R.A.F.; Flt. Sgt. B. D. Walker, R.C.A.F.; Flt. Sgt. D. Gavin, R.A.F.; P/O. R. S. Clement, R.C.A.F.; Sgt. G. Davies, R.A.F.; L.A/C. S. Dixon, R.A.F.V.R.

The King has also given orders for the publication in the *London Gazette* of the names of R.A.F. personnel commended.

ORDER OF THE BRITISH EMPIRE

O.B.E. (Civil Division)

Grp. Capt. G. B. Bailey, Commandant Wales and Mon A.T.C.; Capt. L. Bissen, capt. of aircraft, R.A.F. Ferry Command; W. T. Elliott, supt., Vickers-Armstrongs (Supermarine), Ltd.; A. Keats, joint managing director, Fisher and Ludlow; T. E. H. P. Kennedy, suptg. mechanical and electrical engineer, Air Ministry; E. J. Lowe, local director and works manager, Thomas Firth and John Brown, Ltd.; Observer Cdr. W. G. Moore, Grp. Commandant, R.O.C.; Capt. C. N. C. Pelly, capt. of aircraft, B.O.A.C.; W. A. Sales, dep. director engine production, Ministry of Aircraft Production; A. J. Sheffield, gen. manager, aircraft works, English Electric Co., Ltd.; F. V. Smith, manager, airframe factory, Austin Motor Co., Ltd.; G. F. Sudbury, asst. dir. contracts (fuel), Air Ministry.

M.B.E. (Civil Division)

A. E. Austin, managing director, A.P. Aircraft, Ltd.; W. H. Ball. ch. asst. United Navy, Army and Air Force Bd.; C. Bancroft, repair manager, Brooklands Aviation, Ltd.; F. W. Burnard, works supt., Scottish Aviation, Ltd.; J. H. Chalk, works ch. eng., Bakelite, Ltd.; V. N. Drake, tech. officer, Ministry of Aircraft Production; Miss M. W. Gore, Cdr., A.T.A.; Capt. J. C. P. Higgins, air supt., I.O.M. Air Service; Sqn. Ldr. J. S. Holloway, R.A.F.O., civil substitution officer, R.A.F. Station; C. Holmes, departmental manager, Thomas Firth and John Brown, Ltd.; D. McNicoll, works manager, British Timken, Ltd.; L. P. Marshall, supt. (Airframe Department), Sunbeam Talbot, Ltd.; J. V. Norgate, production control manager, Flexo Plywood Industries, Ltd.; A. F. Russell, Asst. works supt., Blackburn Aircraft, Ltd.; G. W. Shoobert, development eng., K.L.G. Sparking Plugs, Ltd.; E. J. Smith, jun. scientific officer, Operational Research Section, Ministry of Aircraft Production; G. G. Smith, head of section, A.I.D., Ministry of Aircraft Production; Observer Officer C. C. Tapp, tech. adviser, R.O.C.; G. E. Thornton, chn. A.T.C. local committee, Salisbury; B. W. M. Wakefield, ch. tool designer, Rotax, Ltd.; G. W. Wallis, sen. staff officer, Maintenance Command, R.A.F.; W. R. Walton, asst eng., G.P.O., Coastal Command, H.Q., R.A.F.; Miss E. M. Watson, jun. exec. officer, Ministry of Production.

BRITISH EMPIRE MEDAL

(Civil Division—United Kingdom)

A. Anderson supervisor, Air Ministry Radio Station, Scotland; Miss E. E. Batty, ch. chargehand, G.Q. Parachute Co., Ltd.; W. H. Bird, rep. of Rolls-Royce, Ltd., Ministry of Aircraft Production Experimental Establishment; G. Blundell, cartographical draughtsman, No. 12 Group, R.A.F.; P. Britton, cutter grinder, Aero Engines, Ltd.; H. Broadley, station engineer, R.A.F. Station, Lympne; R. W. E. Carr, flight shed manager, Gloster Aircraft Co., Ltd.; W. J. Christopher, civilian instr., No. 1 Air Armament School, R.A.F.; C. A. Cleverly, civilian instr., No. 1 Radio School, R.A.F.; W. S. Crew, station eng., R.A.F. Station, Luqa, Malta; W. S. Davis, ch. observer, R.O.C.; F. W. Deats, millwright, Corfield and Buckle, Ltd.; I. P. Dronfield, chargehand turner, Rootes Securities, Ltd.; A. V. Edmunds, rep. of Bristol Aeroplane Co., Ministry of Aircraft Production Experimental Establishment; J. Ellul, fitter, Air Ministry Works Dept., Malta; C. C. Evans, site foreman, No. 9 Maintenance Unit, R.A.F., Ministry of Aircraft Production; A. N. Gale, inspector of works, Air Ministry; Miss C. D. McP. Gray, mess clerk, Prestwick Airport; F. J. Gutsell, aeroplane spotter, Newhaven, Southern Rly.; R. J. Hall, toolroom foreman, N. Aluminium Co., Ltd.; A. Hamilton, foreman, capstan section, Bruntons (Musselburgh), Ltd.; J. Harrison, head observer, R.O.C.; T. J. D. Jarvis, princ. foreman of stores, No. 3 Maintenance Unit, R.A.F.; Mrs. M. R. Jeffries, bombsight assembler, Aron Electricity Meter, Ltd.; I. G. Jones, employee, de Havilland Aircraft Co., Ltd.; A. Leckie, ch. observer, R.O.C.; J. Lee, skilled fitter, Bristol Aeroplane Co.; A. N. Lumsden, foreman, Aircraft Works, L. and N.E.R.; A. McLachlan, civilian inst., Sunderland Wing, A.T.C.; W. W. Maskell, mess steward (grade I), R.A.F. Station, Henlow; A. Morris, gang leader and welder, Taylorcraft Aeroplanes (England), Ltd.; H. J. Myland, sen. hand, milling section, R. B. Pullin and Co., Ltd.; C. J. Norman, foreman, airframe dept., Austin Motor Co., Ltd.; C. Oxnard, service engineer, Vickers-Armstrongs, Ltd.; H. R. Pearce, ch. observer, R.O.C.; J. L. Pickett, supervisor, dispatch dept., Hawker Aircraft, Ltd.; J. E. Smith, ast. ch. draughtsman, Short Bros., Ltd.; J. G. Smith, jig and tool fitter, Vickers-Armstrongs, Ltd.; W. J. Smith, foreman, instrument assembly shop, Sperry Gyroscope Co.; E. J. Ward, scientific instrument maker, Aeronautical and Gen. Instruments, Ltd.; J. H. Ward, detail fitter, Sir W. G. Armstrong Whitworth Aircraft, Ltd.; R. H. Willis, D/F operator, No. 15 Gp. Coastal Command, R.A.F.

BRITISH EMPIRE MEDAL

(Military Division)

ROYAL AIR FORCE

Flt. Sgt. E. Barber, R.A.A.F.; Flt. Sgt. C. Banks, R.A.F.; Flt. Sgt. W. Boughton, R.A.F.; Flt. Sgt. J. M. Duggie, R.A.F.; Flt. Sgt. F. T. Ethelstone, R.A.F.; Flt. Sgt. J. L. Foster, R.A.F.; Flt Sgt. I. D. Fraser, R.A.F.; Flt. Sgt. C. J. E. Golding, S.A.A.F.; Flt. Sgt. J. Gray, R.A.F.; P/O P. L. Kelly, R.A.F.; Flt. Sgt. D. Keyter, S.A.A.F.; P/O A. R. Nash, R.A.F.; Flt. Sgt. W. Pickup, R.A.F.; Flt. Sgt. A. A. Warren, R.A.F.; Flt. Sgt. H. Adams, A.A.F.

Flt. Sgt. L. C. Andrews, R.A.F.; Flt. Sgt. W. T. Bussey, R.A.F.; Flt. Sgt. W. G. Cooper, R.A.F.; Flt. Sgt. R. C. F. Cottrell, R.A.F.; Flt. Sgt. T. A. Evans, R.A.F.; Flt. Sgt. E. W. Hayward, R.A.F.V.R.; Flt. Sgt. G. T Hook, A.A.F.; Flt. Sgt. E. R. Jones, R.A.F.; Flt. Sgt. E. Mills, R.A.F.V.R.; Sgt S. C. M. Ames, R.A.F.V.R.; Sgt. F. W. Barling, R.A.F.V.R.; Sgt. G. Duffin, R.A.F.; Sgt. K. W. Penny, R.A.F.; Sgt. H. G. Stewart, R.C.A.F.; Sgt. R. A. M. Thompson, R.A.F.; F/O W. G. Toogood, R.A.F.; Sgt. R. C. L. Williams, R.A.F.V.R.; Cpl. W. H. Abbs, R.A.F.V.R.; Cpl. H. Barr, R.A.F.; Cpl. F. Davies, R.A.F.V.R.; Cpl. R. P. W. Fairbrother, R.A.F.V.R.; Cpl. W. J. Friend, R.A.F.V.R.; Cpl. V. L. Maynard, R.A.F.V.R.; Cpl. B. A. Trail, R.A.F.V.R.; L.A/C. J. W. Hawley, R.A.F.V.R.; L.A/C. W. Leaver, R.A.F.V.R.; L.A/C. G. T. Lucas, R.A.F.V.R.; Flt. Sgt. E. F. A. France, W.A.A.F.; Flt. Sgt. N. M. Shepherd, W.A.A.F.; L.A/CW. P. M. Budd, W.A.A.F.

CANADIAN SERVICES

ORDER OF THE BATH

C.B. (Military Division)

A.V-M. N. R. Anderson, R.C.A.F.; A.V-M. F. V. Heakes, R.C.A.F.; A.V-M. L. F. Stevenson, R.C.A.F.; A.V-M. J. A. Sully, R.C.A.F.

ORDER OF ST. MICHAEL AND ST. GEORGE

C.M.G.

H. G. Norman, Montreal, Financial Adviser in connection with Commonwealth Air Training Plan; H. J. Symington, K.C., Montreal, Power Controller and President, Trans-Canada Airlines.

ORDER OF THE BRITISH EMPIRE

ROYAL CANADIAN AIR FORCE

C.B.E. (Military Division)

Air Comdre. K. M. Guthrie, R.C.A.F.; Air Comdre. W. J. Seward, R.A.F.; Grp Capt. A. P. Campbell, R.C.A.F.; Grp. Capt D. E. Mackell, R.C.A.F.

O.B.E. (Military Division)

Wing Cdr. A. A. F. Hickman, R.A.F.; Wing Cdr. Z. L. Leigh, R.C.A.F.; Wing Cdr. K. R. Patrick, R.C.A.F.; Wing Cdr J. A. Sharpe, R.C.A.F.; Sqn. Ldr. W. R Franks, R.C.A.F.

M.B.E. (Military Division)

Wing Cdr. P. A. Cumyn, R.C.A.F.; Wing Cdr. W. R. Irwin, R.C.A.F.; Wing Cdr. J. Kerr, R.C.A.F.; Wing Cdr. J. G. Portlock, R.A.F.; Wing Cdr D. W. Stoneham, R.C.A.F.; W/O. W. Walker, R.C.A.F., Women's Divn.; Sqn. Ldr. R. J. Gray, R.C.A.F.; Sqn. Ldr. W. K. Gwyer, R.C.A.F.; Sqn. Ldr. D. P. Jamieson, R.C.A.F.; S/O. K. L. Jeffs, R.C.A.F., Women's Divn.; Sqn. Ldr. A. J. Mould,

NEW YEAR HONOURS

R.A.F.; Sqn. Ldr. A. H. Nanton, R.C.A.F.; Sqn. Ldr. W. J. Ralphs, R.A.F.; Sqn. Ldr. W. Ramsden, R.C.A.F.; Sqn. Ldr. R. M. Trites, R.C.A.F.; Sqn. Ldr. F. Vernon, R.A.F.; Sqn. Ldr. C. C. Wyatt, R.C.A.F.; F/O. E. A. Griffin, R.C.A.F., Women's Divn.; W/O. L H. Perry, R.C.A.F.

BRITISH EMPIRE MEDAL
(Military Division)
ROYAL CANADIAN AIR FORCE

Flt. Sgt. L. M. Begley, R.C.A.F.; Flt. Sgt. G. R. Charron, R.C.A.F.; Flt. Sgt. H. R. Chipperfield, R.C.A.F.; Flt. Sgt. R. A. Englebert, R.C.A.F.; Flt. Sgt. R. J. Gourley, R.C.A.F.; Flt. Sgt. R. C. D. Honour, R.C.A.F.; Flt. Sgt. C. A. Jones, R.A.F.; Flt. Sgt. R. P. Leitch, R.C.A.F.; Flt. Sgt. A. McInnes, R.A.F.; Flt. Sgt. J. Moore, R.A.F.; Flt. Sgt. G. A. White, R.A.F.; Sgt. M. E. Boreham, R.C.A.F., Women's Divn.; Sgt. P. C. Dubois, R.C.A.F.; Sgt. R. L. Fogg, R.C.A.F.; Sgt. C A. Hobbs, R.C.A.F.; Cpl. C. E. Giorgianni, R.C.A.F.

AIR FORCE AWARDS

DISTINGUISHED FLYING CROSS

For gallantry and devotion to duty in the execution of air operations:—

Wing Cdr. W. C. Van Camp, R.C.A.F.; Flt. Lt. A. A. T. Imrie, R.C.A.F.; P/O. C. O. Godfrey, R.C.A.F.

AIR FORCE CROSS

Wing Cdr. H. O. Madden, R.C.A.F.; Sqn. Ldr. R. H. Hyndman, R.C.A.F.; Sqn. Ldr. V. M. Terry, R.C.A.F.; Sqn. Ldr. H. M. Wilson, R.C.A.F.; Flt. Lt. D. H. Armstrong, R.C.A.F.; Flt. Lt. J. M. Betts, R.A.F.V.R.; Flt. Lt. J. F. Dobbs, R.A.F.; Flt. Lt. R. F. Eastwood, R.A.F.V.R.; Flt. Lt. H. R. Edge, R.A.F.; Flt. Lt. W. S. Jenkins, R.A.F.; Flt. Lt. A. Patton, R.C.A.F.; F/O. C. B. Bruce, R.C.A.F.; F/O. A. K. Miller, R.C.A.F.

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Flt. Sgt. J. J. H. Dadey, R.C.A.F.; L.A/C. T. A. Howard, R.C.A.F.

AUSTRALIAN LIST

O.B.E. (Military Division)

Wing Cdr. J. O. P. Dibbs, R.A.A.F.

M.B.E. (Military Division)

W/O. G. Green, R.A.A.F.; Sqn. Ldr. A. C. A. McBride, R.A.A.F.; Flt. Lt. W. J. Symons, R.A.A.F.

AIR FORCE CROSS

Sqn. Ldr. K. E. Wedgwood, R.A.A.F.

NEW ZEALAND LIST

ORDER OF THE BRITISH EMPIRE

O.B.E. (Military Division)

Sqn. Ldr. R. J. Gibbs, R.N.Z.A.F.

M.B.E. (Military Division)

W/O. J. E. K. McConnell, R.N.Z.A.F.

AIR FORCE CROSS

Sqn. Ldr. R. Fletcher, R.N.Z.A.F.; Sqn. Ldr. A. M. Harvie, R.N.Z.A.F.

BRITISH EMPIRE MEDAL
(Military Division)

Cpl. W. L. Fairweather, R.N.Z.A.F.

SOUTH AFRICAN LIST

ORDER OF THE BRITISH EMPIRE

C.B.E. (Military Division)

Col. R. Douglas, S.A.A.F.

O.B.E. (Military Division)

Lt. Col. R. S. Brophy, S.A.A.F.; Lt. Col. W. G. Driver, S.A.A.F.; Maj. F. W. Bailey, S.A.A.F.; Maj. J. A. C. Mayhew, S.A.A.F.; Maj. H. Natrass, S.A.A.F.

M.B.E. (Military Division)

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BRITISH EMPIRE MEDAL
(Military Division)

Mrs. A. A. Shuman, W.A.A.S. (Dir. of Recruiting).

AIR FORCE CROSS

Lt. Col. L. E. Lang, S.A.A.F.; Lt. Col. P. W. A. Nel, S.A.A.F.; Maj. L. E. D. Inggs, S.A.A.F.; Maj. P. R. Kock, S.A.A.F.; Maj. P. S. B. Krige, S.A.A.F.; Maj. R. O. Southey, S.A.A.F.; Capt. F. W. J. Allen, S.A.A.F.; Capt. R. K. Dunkerley, S.A.A.F.; Capt. F. M. F. Ellis, S.A.A.F.; Capt. H. J. C. Gray, S.A.A.F.; Capt. D. B. Hauptfleisch, S.A.A.F.; Capt. G. K. Jones, S.A.A.F.; Capt. E. J. Kelly, S.A.A.F.; Capt. E. R. Larter, S.A.A.F.; Capt. E. R. Mauritzi, S.A.A.F.; Capt. J. Prinsloo, S.A.A.F.; Capt. P. M. Retief, S.A.A.F.

D.S.C.

Sub. Lt. (A) J. A. Barnes, R.N.V.R.; Sub. Lt. (A) J. W. Barnes, R.N.V.R.; Sub. Lt. (A) J. M. Threlkeld, R.N.V.R.

D.S.M.

C.P/O. Airman L. G. Long; P/O. Air Mech. (E) W. P. Moorcroft.

Altitude Sounding

Suggested Use of Sounding Rocket for Meteorological and Scientific Exploration of Atmosphere and the Investigation of Cosmic Radiation

By K. W. GATLAND*

WEATHER forecasts to-day play an ever-increasing part in the direction of aerial warfare, and often upon the range and accuracy of a particular meteorological survey will depend the success or failure of a planned excursion into enemy territory. On numerous occasions reports of highly organised raids on specific targets have told of the effect of unforeseen changes in atmospheric conditions, often resulting in such announcements as, for instance, "... severe icing conditions encountered on the return journey, it is considered, were largely responsible for the loss of several of our machines which otherwise might have returned safely ...," illustrating how the range of the meteorological forecast was insufficient to give adequate data to cover the entire duration cf the operation.

Peacetime Surveys

In the days of peace, accurate meteorological surveys will be as essential a requirement to operating the world's airlines with the precision of efficiency which considerations of safety, comfort and general high organisation demand, and a higher percentage accuracy of prediction will be the constant need.

The development of the rocket for sounding purposes would enable penetration to altitudes impossible by other means, enabling more detailed examination of the atmosphere at extreme altitudes to make possible long-range forecasts of weather conditions at lower levels, which, in effect, would raise meteorology to the status of an exact science.

Not only would the sounding rocket assist in this way, but, used for more specific scientific purposes, to record the solar spectrum, and investigate electronic phenomena, for instance, by exploration to the very limits of atmosphere, its possibilitites are further enhanced.

There is probably no subject in the realm of science in which so many conflicting theories have been advanced as in the investigation of cosmic radiation. Some authorities assert that these rays have direct bearing on the human system in a variety of ways, influencing growth, life-span and general health, yet relatively nothing is known of them. It is generally agreed that these rays emanate from the depths of outer space—by what means is uncertain, and, moreover, it is still a matter for conjecture whether the effects noticeable at sea-level are due to the rays themselves or to secondary radiations produced by the direct action of cosmic bombardment upon the atmosphere.

Investigation of extreme altitudes to establish conclusive proofs of atmospheric conditions, and the true effects of cosmic radiation, may well influence the many fields of science far beyond the comprehension of to-day's imagination.

The M.A.A. Sounding Rocket

An investigation into the problems of high-altitude sounding, recently concluded by the Manchester Astronautical Association, has resulted in the detailed design of an experimental altitude rocket, incorporating several original features. The model undergoing development at the moment is intended solely for test purposes, but if expectations are realised larger types will be built to carry recording instruments. The dimensions of the preliminary rocket have been maintained at the lowest practical limit, and in consideration of size its calculated range is considerable.

The design of the motor and, in fact, most of the equipment, have

* The author is secretary of the joint committee of the Astronautical Development Society and the Manchester Astronautical Association.

been based on proving stand data, and the figures taken into consideration are average, and not max. Employing liquid oxygen, with petrol as fuel, the rocket (see illustration) consists basically of the following components: the reaction motor; liquid-oxygen tank; petrol tank (with gas charger); gyro-control, and parachute—encased in a light metal shell.

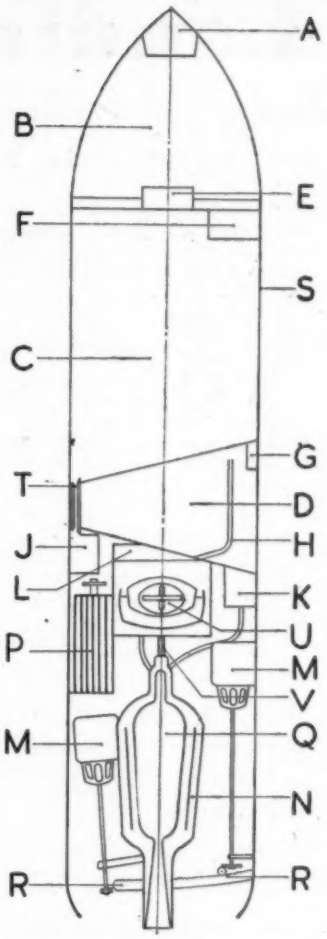
The method employed in the mounting of the reaction motor is rather original, in that a gyro-control, brought into play immediately the rocket deviates from its true path, at once effects variation of the direction of thrust—the motor being pivoted at the "head" by means of a universal thrust bearing, and at the nozzle end held in place by a system of slides and ratchets. This ensures easy movement of the motor in any direction around the central pivot, to apply thrust at angles ranging from 0 to 15 degrees from the axial thrust line. Reversible field electric motors serve to effect movement of the reaction motor. No motive power is provided in the rocket for the function of the master gyroscope, which is rotated just prior to flight by means of an auxiliary ground motor. The inertia caused by the initial force of rotation will be sufficient to maintain its efficient operation throughout the period of powered flight.

During the course of the rocket's ascent, any deviation from the true path of flight will, as previously stated, immediately actuate the gyro-control, to effect the function of the servo-motors, thereby changing the direction of thrust of the reaction motor to oppose the deviation and return the rocket to its normal line of ascent.

Fuel Supply

The liquid oxygen and petrol are housed in duralumin pressure tanks, which are designed to allow, as far as possible, unrestricted flow to the reaction chamber. The feeding of the liquid oxygen is a simple matter—being expanded into the reaction chamber by its own pressure, while the petrol is introduced by the pressure of an inert gas (nitrogen), acting directly on to the fuel surface.

The reaction motor, constructed of light aluminium alloy, is internally sprayed with a coating of steel for protection against the high temperatures developed in the reaction chamber and nozzle throat. The main parts are detachable to facilitate replacement should any of the components "burn-out," or become otherwise damaged during proving stand tests. The outer sides of the reaction chamber are ribbed by longitudinal cooling fins, air being introduced via small air-scoops and accelerated by means of negative pressure created by the rush of the exhaust gases, to effect a swift, cooling flow past the reaction motor.



A and E, parachute release mechanism; B, parachute compartment; C, liquid oxygen tank; D, fuel tank (petrol); F, liquid oxygen safety valve and filler; G, fuel filler cap; H, nitrogen pressure feed pipe; J, oxygen valve; K, fuel valve; L, nitrogen valve; M, servo reversible field motors; N, reaction motor cooling fins; P, electric storage cells; Q, reaction motor; R, reaction motor guides; S, cylindrical rocket shell; T, oxygen feed pipe; U, gyroscope (including electrical switch, relays and controls); V, universal thrust bearing.

The parachute, housed in the nose of the rocket, is opened by means of a release mechanism, adjusted to function when the air pressure inside the lower shell is built up to a pre-determined figure, as the rocket falls back to earth tail first, due to the weight displacement when the tanks are empty. Should, however, the rocket descend nose first, due to accident, an auxiliary device is fitted in addition to release the parachute.

Performance

General particulars of the design, and calculated performance figures are given below.

The total weight of the rocket is 50.0 lb., of which 22.5 lb. is fuel and 27.5 "payload." The itemised weight statement follows, the figures being in pounds: Motor, 2.8; oxygen, 17.8; petrol, 4.7; nitrogen, 3.0; gyro controls, 4.0; motor supports, 0.6, fuel tank ends, 1.2; fuel tank case, 3.3; curved ends of rocket, 5.2, copper tubing, 0.9; nitrogen tank, 1.0; parachute, 0.5; parachute release, 0.2; extras, 4.8 lb.

The volume of liquid oxygen is 0.20 cu. ft., and of petrol, 0.08 cu. ft. Following are the main dimensions, in inches: Length of oxygen tank, 10.0; radius of oxygen tank, 4.0; length of petrol tank, 3.0; radius of petrol tank, 4.0; overall length of tanks, 13.0; overall length of rocket, 35.0; diameter of rocket shell, 8.0; length of motor, 10.0in.

Estimated power and performance characteristics are as follows: Jet flow, 0.464 lb./sec.; jet reaction, 53.280 lb.; expansion ratio, 50,000; area of nozzle throat, 0.049 sq. in.; coefficient of drag of shell, 0.03; frontal area of shell, 0.356 sq. ft.; reaction chamber pressure, 700 lb./sq. in.; fuel tank pressure, 1,050 lb./sq. in.; jet velocity, 5,000 ft./sec.; acceleration, 24 ft./sec./sec.; time of power (a = k), 43 sec.; time of power (v = k), 5 sec.; time of no power (a = −g), 30 sec.; total time ascending, 78 sec.; height reached under power (a = k), 23,000ft.; height reached under power (v = k), 6,000ft.; height reached under momentum, 18,000ft.; total height reached, 47,000ft.

HE SHOULD KNOW

A PILOT who began bombing the Germans three years ago and is still bombing them has said that he notices little difference in the opposition then and now.

He is Sqn. Ldr. E. H. O'Neill, D.F.C., of Melbourne, who was among the first group of Australian airmen trained under the Empire Scheme to arrive in Britain on Christmas Day, 1940. He now receives the D.S.O. for "great success due to courage, determination and skill," says the Air Ministry News Service.

Sqn. Ldr. O'Neill believes that the "sameness" of the opposition is due to the fact that though the Germans have increased their defences tremendously our bomber force has increased even more so, and the individual crew receives about the same degree of attention now as always.

"But the difference between the aircraft I flew then and now is immeasurable," he says. "The Mosquitoes are through the ground defences almost before the enemy is aware that they are overhead, and they fly so fast that the fighters cannot catch them."

Sqn. Ldr. O'Neill has flown Mosquitoes, Wellingtons and Lancasters, bombed the heavily defended Ruhr nearly 30 times and most other important targets several times. He won his D.F.C. in November, 1941, for an attack in which the Gneisenau was hit at Brest, and bombing Bremen when he had about 150 holes shot all over his machine.

Tricycle Landing Gears

A Review of Design and Performance Criteria

*GROUP CLASSIFICATION: B.3

THE susceptibility of the conventional tail wheel type of landing gear to nosing over under a strong braking effort, its inherent tendency to ground-loop, particularly in a side-wind, and the necessity of making a full-stall landing to prevent bouncing have made it less and less satisfactory as landing speeds have increased. If properly designed, the tricycle landing gear will eliminate these undesirable characteristics, but it may introduce other objectionable features peculiar to its type. Among these are porpoising, longitudinal instability with the nose-wheel off the ground, shimmy of the nose-wheel and failure of the nose-wheel strut from excessive dynamic loads. In addition, it should be remembered that the elimination of the faults in the conventional gear will result in increased loads on the tricycle gear and airframe structure. The removal of the possibility of nosing over will lead to faster taxying and manœuvring on the ground; the elimination of the tendency to ground-loop will result in more cross-wind landings, and the lack of any tendency to bounce will result in more landings at high sinking speeds.

*THIS is the fourth in the series of articles based on abstracts from the world's scientific and technical Press as compiled by R.T.P.3 Section of the M.A.P.

The subjects dealt with in the series are divided into the following groups :—

A. Aerodynamics and Hydronamics.
B. Aircraft and Airscrews.
C. Engines and Accessories.
D. Materials and Methods.
E. Instruments and Devices.
F. Production.
G. Physiology and War Medicine.

Each article appearing will carry its classification group letter followed by a number indication that it is the 2nd, 4th, 7th, etc., in that group to be published.

The articles will not necessarily appear in the alphabetical order of their groups.

A paper read before the U.S. *Institute of the Aeronautical Sciences* by Jenkins and Donovan, dealt with the design and performance aspects of tricycle undercarriages in a most comprehensive manner. In the authors' opinion many of the investigations so far carried out, both theoretic and experimental, are erroneous, since they are only an adaptation of conventional landing gear criteria to the geometry of tricycle gears, or have not been reviewed in the light of practical experience For example, the effect of the *wheelbase, i.e.*, the distance between the nose-wheel and main wheels' axles, on the characteristics of the landing gear cannot be determined without considerations of its location relative to the centre of gravity and the distance of the main wheels aft of the aerodynamic centre.

Mode-of-Landing Effect

The distance of the nosewheel from the aircraft's c.g. principally affects the nosewheel load and also has an influence on the resistance to porpoising and the stability against overturning. The size of the loads placed on the nosewheel by the landing impact, in turn, depend on the type of landing made, *e.g.*, (i) three-wheel landing, (ii) main wheels first, or (iii) nose-wheel first. In the three-wheel landing, the load distribution between the front and rear wheels is usually assumed to be the same as the static distribution; an assumption which can be considerably modified by the effect of the shock absorber on the nose-wheel assembly.

In a main-wheels-first landing, the proximity of the rear wheels to the c.g. will result in most of the energy being absorbed there. The loads on the nose-wheel produced by the subsequent dropping of the aircraft's nose may therefore be expected to be less than in a three-wheel landing. In a nose-wheel first landing, the nose-wheel striking the ground tends to rotate the aircraft about its lateral axis, so that the load on the nose-wheel depends on the pitching moment of inertia of the particular aircraft. The acceleration at the nose-wheel may be found, in turn, from the shock absorber travel and the aircraft sinking speed; unlike the three-wheel landing case, the total wheel base has no critical effect on the nose-wheel reaction.

Load Distribution

The general load distribution of the aircraft naturally plays a decisive rôle in the determination of landing gear loads. In order to illustrate these conditions, it is possible to represent the aircraft by an arrangement of two concentrated masses, one of which is located directly over the nose-wheel and corresponds to the load produced by the landing impact in a nose-wheel first landing, whereas the second is located at a distance aft of the c.g. which may be determined by the distance of the nose-wheel from the c.g., and the aircraft's radius of gyration. A calculation carried out with a single-engined, single-seater tricycle machine, driven by an engine and tractor airscrew mounted in the nose has revealed a radius of gyration of nearly 18.4 per cent. of the aircraft length, whereas the distance of the nose-wheel from the c.g. is between 20 and 35 per cent. of the aircraft length.

This means that between 46 and 22 per cent. of the aircraft's weight acts on the nose-wheel; since the static percentage is usually only about 15 per cent., the error in designing from the load in the three-wheel attitude *may exceed 200 per cent.*, assuming the same sinking speed in both conditions. These figures apply only to the type of aircraft outlined above, and they vary widely in other types, depending upon loading conditions, size, etc.; the ratios between nose-wheel first, and three-wheel percentages of weight acting on the nose-wheel have been found to vary from 4 : 1 to 1½ : 1.

In order to reduce the weight actually on the nose-wheel, it is useful to select the largest possible distance between the nose-wheel and the c.g.; it is wise, furthermore, to make the travel of the nose-wheel considerably greater than that of the main wheels, by which means the acceleration in a nose-wheel first landing and the loads on the nose-wheel and structure will be reduced.

Of much greater importance than the location of the nose-wheel is the *distance of the main wheels aft of the c.g.*, because this affects more of the properties than any other single characteristic. It influences not only the directional and longitudinal stability, the length of take-off run and the static reaction on the nose-wheel, but also the ability to land with excess air speed and high sinking speed without bouncing. This distance is determined partly by the requirement that the aircraft's c.g. must be ahead of the main wheels even when the tail buffer is against the ground. Thus the vertical forces acting at the main wheels will tend to decrease the angle of attack of the aircraft, reducing the lift and preventing it from rising into the air again.

As it is normally desirable to make the take-off with the nose-wheel off the ground, the aircraft must be stable longitudinally when running only on the rear wheels, other-

TRICYCLE LANDING GEARS

wise it will fall back into the three-wheel position. To be stable, the condition is that any change in the angle of attack must produce a moment on the aircraft tending to restore it to its original attitude.

The moments acting on the machine while taxying result from gravity, air forces and wheel friction, and the problem is, therefore, to calculate the total of the three effects. It has been shown that the effect of gravity will always increase the angle of attack and thus unstabilise the aircraft, whereas the air forces will stabilise it when a certain speed has been attained. At low speeds an aircraft running only on the main wheels will thus always be unstable; however, since at low air speeds the forces acting upon the tail unit are not strong enough to lift the nose-wheel from the ground, this fact is not of real significance. It is sufficient that the aircraft becomes stable just prior to becoming air-borne, but should this not be the case, the nose-wheel must be kept on the ground until the aircraft reaches a speed in excess of its nominal take-off speed.

The two requirements outlined restrict the location of the main wheels, in relation to the aircraft's c.g., to a small area; the most favourable location being at the minimum distance from the c.g., as determined by the necessity that the c.g. must be ahead of the main wheels even when the tail buffer touches the ground.

Directional Stability

The ready *steerability* during taxying, which may be of importance during the take-off of tricycle aircraft, is determined by the distance of the rear wheels aft of the c.g. and the height of the c.g. above the ground line; neither of these dimensions is related to the wheel tread (circumference). Since tricycle aircraft are inherently directionally stable as long as the main wheels are situated aft of the c.g., the problem becomes one of the degree of directional stability desired.

Whilst in an aircraft with a conventional undercarriage the pilot must counteract instability during a taxying turn or during the landing or take-off by means of differentially operating the wheel brakes, the conditions are just the contrary in the case of a tricycle landing gear; in order to make a taxying turn the stabilising moment of the nose-wheel arrangement must be partially eliminated. Accordingly, the sharpness of the turn depends on the magnitude of the turning moment that can be applied, which, assuming the turn is done by differential braking, depends on the wheel tread and tyre coefficient of friction.

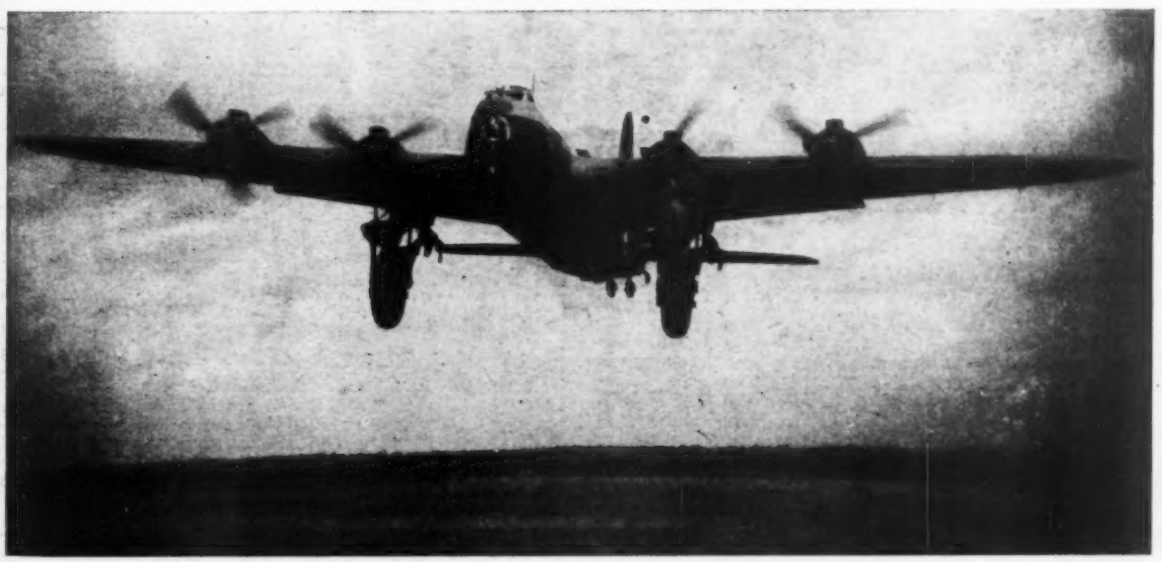
Limitations of Turn Radii

As long as the aircraft runs at a certain speed, sharp changes of direction are not possible. A normal single-seater fighter, for example, whose wheel tread is assumed to be 8.33ft., wheelbase 10ft., distance of the nose-wheel from the c.g. 8.75ft., and height of the c.g. above the ground line 5ft., has a turn radius of 175ft. at a taxying speed of 30 m.p.h. with the inner main wheel locked solid and skidding. Since the radius is proportional to the square of the speed, no serious consequences would result from locking one wheel even when landing. By increasing the tread, the steering characteristics are improved somewhat; however, a turn radius of less than the minimum should be avoided owing to the sideways skidding of the wheels. The aircraft outlined, for example, would begin to skid sideways on all three wheels at 30 m.p.h. for a turn radius of 125ft., and no matter to what the tread was increased beyond the corresponding 13.75ft., the aircraft could not turn around in a circle of less than 125ft. diameter at 30 m.p.h.

The effect of the swivelling nose-wheel is a stabilising one, but makes itself noticeable only at a very small radius of turn, and is negligible in radii of five times the tread.

The questions studied so far cover only part of the problem which must be considered in the design of tricycle landing gear. The nose-wheel itself represents another field for the study of which relatively incomplete documentation is available. As is known, the swivelling nose-wheel tends to execute shimmying movements, particularly at medium taxying speeds, and under certain circumstances these movements may place excessive loads on the landing gear and airframe. The elimination of shimmying with the help of mechanical or hydraulic damping devices, the relation between nose-wheel design, nose-wheel loads and damping forces required, have largely been explained only empirically up to the present.

HERCULEAN TASK OVER



With its Bristol Hercules engines just ticking over, a Short Stirling comes in to land. The Stirling was the first of our big heavies to go on operations and it is still giving very excellent service.

CORRESPONDENCE

The Editor does not hold himself responsible for the views expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

JET PROPULSION

"Flight's" Faith is Vindicated

THIS must be a great day for you. The advocator of a system against great opposition and now—the whole world greeting jet propulsion as an achievement and a reality.

My heartiest congratulations.

Having conquered this field, what are you going to turn your hand to next? H. L. R.

THEORY OF FLIGHT

Dumping Process Worsens L/D Ratio

HAVING followed the "Dump or No Dump" controversy in your Correspondence columns with some degree of interest, it does not seem to have occurred to anyone that before a condition of lightened weight can be achieved, something has got to be pitched overboard, and this can only mean opened hatches and increased resistance. Even a column of liquid fuel leaving the aircraft can hardly be expected to increase the aerodynamic efficiency, all of which must result in a worsened L/D ratio for the whole period of time occupied in the jettisoning operation. This condition can only be balanced by a coarsened gliding angle.

Obviously, with the jettisoning completed, the aircraft will revert to its original order of L/D and angle of glide, and without going into the question of speeds and distance, its flight path will have become stepped down to an extent which would probably negative any gain that jettisoning might promise.

S. H. BOSTOCK.

BRISTOL TORPEDO

Development of the Bellows Flap

MY attention has been drawn to the September 2nd issue of your journal (page 253) describing a "bellows flap" on the Beaufighter torpedo plane manufactured by the Bristol Co.

The type of flap fitted to the Beaufighter is known as the "Youngman bellows flap," and was first proposed by me some seven years ago and later developed by me full scale as an airbrake under the auspices of the Fairey Aviation Co. At the suggestion of the Ministry of Aircraft Production the installation on the Beaufighter followed this development work under my direction and introduces nothing new in the method of operation.

The development work done by the Bristol Co. was confined to the application of the bellows flap to the particular needs of the Beaufighter, such as the best disposition of the flaps on the wing to avoid sudden changes in lift, pitching moment, and the avoidance of tail buffeting.

R. T. YOUNGMAN.

BOMBER ARMAMENT

Muzzle h.p. the Only Fair Test

I HAVE read Robert Chorlton's letter of December 16th, and should like to occupy your valuable space once more on an important subject.

Whether air-gunners worry about it or not, the fact remains that muzzle horse-power $\left(\frac{mv^2r}{35,420}\right)$ is the only fair test of a gun's merit. It takes all factors into account—mass, velocity and rate of fire.

The instalment of 0.5in. and 20 mm. guns in fighters (which fight much more split-second actions than bombers) shows that the strikes per sec. of the 0.5in. (12.5) and of the 20 mm. (10.8) are more than adequate.

The question of additional weight should not deter anyone from installing higher-calibre guns. Bigger aircraft (with more h.p.) and/or fewer guns is the answer, e.g., as in the Typhoon IB, successor to the Hurricane I; the Spitfire Vc, successor to the Spitfire I, and the Hurricane IIc, successor to the I.

We must progress and plan ahead. That is why the Americans have a temporary advantage.

"YOUNG SPOTTER."

THE CASE FOR THE FLYING BOAT

Why Not Amphibian?

AFTER reading the two articles in *Flight* concerning flying boats in the post-war years, the Saunders Roe report, and C. A. H. Pollitt's article, "Where Angels Fear . . . ," a possible compromise occurred to me—if it were necessary, considering the large percentage of converted military aircraft which will obviously be used for transport in these years.

However, for discussion's sake, the obvious solution would appear to be the amphibian. Even though I, too, may be "rushing in, etc.," knowing only a limited amount of aircraft construction difficulties as I do. I have heard many derogative remarks passed about the amphibian—"Elephantine," etc.—but I would beg to recall one very successful example to such sceptics—the inimitable "Walrus." Not as an aerodynamic criterion, but as an example of good and successful service.

Admittably, it was rather a stringbag, and, as far as I know, no very aerodynamically good amphibian has yet been built, but why should it not be possible to improve?

One could envisage a four-engined aircraft (or larger, should any of the more optimistic futurists wish it) with a similar general layout to the Boeing Clipper type, the stub-wing being necessary for efficiency. This would afford the necessary mounting for a fairly wide wheel base without the extra weight entailed in a high-wing retractable wheel layout. The main wheels would not have to have very long legs either, thus eliminating complications and unnecessary weight to a minimum. Generally, the undercarriage would be tricycle, the nose wheel retracting backwards into a watertight compartment, and well-constructed well-doors providing a good planing surface, together with a certain watertightness to protect the wheel itself. The main wheels would retract inwards into similarly constructed wells. The comparatively low clearance necessary would allow the main wheel legs to be short, and therefore it would be unnecessary to tamper with the chines, the stub wing being sufficient to carry the retracted wheels. The stub wing would, of course, have to be set fairly far back in order to provide a long wheel base and prevent "nosing over."

The advantages of such an aircraft would be many, and even the flying boat seems very desirable in any post-war planning. There is no necessity to enumerate the various advantages of the flying boat over the land plane, as they are admirably set out in the Saunders Roe report. Mr. Pollitt has only given two points to back his theory that there will be no place for flying boats. They are, admittedly, good points, but I believe that one of them, at any rate, could be eliminated by the amphibian—that the flying boat only provides coast to coast service.

To quote Mr. Pollitt's own case, such an amphibian as I have described above could take off from Birmingham for Southampton, possibly carrying extra pay-load for the short distance, landing there, refuelling and flying, either straight to Jo'burg, or to Durban, and repeating the process.

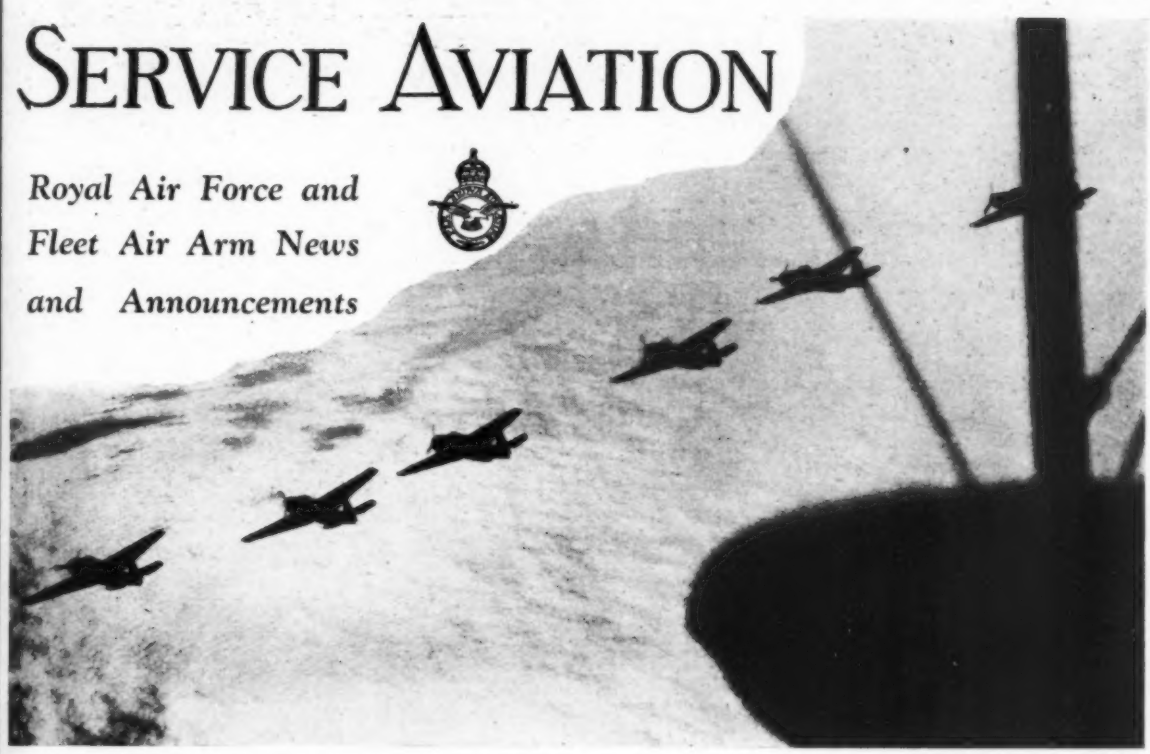
One amphibian would also eliminate the necessity of a floating dock for servicing, as, obviously, it could be run up into a hangar at a sea terminal, if necessary, without any difficulty, merely by the construction of a concrete ramp. In any case, it could be serviced at a land terminal. Even should a floating dock be necessary (for a flying boat), it seems that a simpler method would be to provide a longer overhead system, and provide retractable servicing platforms for all engines, without the necessity of extensible platforms for the outboard engines.

Another point in favour of the flying boat which is often forgotten is the safety factor. Should an aircraft have to "force-land" on the sea, a flying boat has the obvious advantage, and an amphibian has the further advantage of being able to "force-land" on both sea and land (depending, of course, on whether the sea or land is smooth enough). Furthermore, there is the not inconsiderable psychological effect on any inexperienced passengers—and there will be many in the immediate post-war years. Obviously, the first thing that would occur to a "first-time passenger" when flying over the sea would be "What happens when we come down?" and the feeling of security provided by a hull would be obviously considerable. Not the sort of thing that would effect post-war planning—or is it?

While on the subject of flying boats, it occurred to me that if the pay-load loss due to chines and steps were 3 per cent., and the pay-load gain due to the elimination of undercarts were 3 per cent., doesn't one cancel . . . ? P. J. EDMUNDS.

SERVICE AVIATION

Royal Air Force and Fleet Air Arm News and Announcements



Fleet Air Arm pilots training on Grumman Avengers at the U.S. Naval Air Base, Squantum, Mass. In the Royal Navy the Avenger is now known by the same name and is no longer the Tarpon.

Promotions

GENERAL DUTIES BRANCH.

Air Marshals (temp.) are granted the rank of Air Marshal, January 1st, 1944.
Sir Bertine E. SUTTON, K.B.E., C.B., D.S.O., M.C.
Sir John S. T. BRADLEY, K.C.B., C.B.E.
Sir Douglas C. S. EVILL, K.C.B., D.S.C., A.F.C.
Sir Trafford L. LEIGH-MALLORY, K.C.B., D.S.O., (Act. Air Chief Marshal).
Sir Arthur T. HARRIS, K.C.B., O.B.E., A.F.C. (Act. Air Chief Marshal).
Air Comdre. H. S. P. WALMSLEY, C.B.E., M.C., D.F.C., is granted the rank of Act. Air Vice-Marshal June 25th, 1943.
Group Capt. (Act. Air Comdre.) A. P. RITCHIE, A.F.C., is granted the rank of Act. Air Vice-Marshal November 18th, 1943.

Awards

THE KING has been graciously pleased to approve the following awards to the personnel indicated who have completed, in various capacities, many successful operations against the enemy, in which they have displayed high skill, fortitude and devotion to duty.

Bar to Distinguished Flying Cross

Act. Wing Cdr. J. A. SLATER, D.F.C., R.A.F.O., No. 103 Sqn.
Sqn. Ldr. C. S. P. RUSSELL, D.F.C., R.A.F., No. 51 Sqn.

Distinguished Flying Cross

Sqn. Ldr. G. A. RODEN, R.A.F.O., No. 12 Sqn.
Act. Sqn. Ldr. A. P. S. CHIPLING, R.A.F.V.R., No. 429 Sqn.
Act. Sqn. Ldr. J. N. DERBYSHIRE, R.A.F.V.R., No. 9 Sqn.
Act. Sqn. Ldr. A. GIBSON, R.A.F.V.R., No. 7 Sqn.
Act. Sqn. Ldr. H. W. COULE, R.A.F., No. 12 Sqn.
Act. Sqn. Ldr. B. PAPE, R.A.F.V.R., No. 166 Sqn.
Flt. Lt. J. R. HENDERSON, R.A.A.F., No. 460 (R.A.A.F.) Sqn.
Flt. Lt. H. T. JONES, R.A.F.V.R., No. 192 Sqn.
Flt. Lt. D. S. KINDER, R.A.F., No. 166 Sqn.
Flt. Lt. A. MACMILLAN, R.C.A.F., No. 426 (R.C.A.F.) Sqn.
Flt. Lt. J. MCCLOY, R.A.F.V.R., No. 51 Sqn.
Flt. Lt. P. G. SOOBY, R.A.F.O., No. 109 Sqn.
Flt. Lt. W. M. B. THOMPSON, R.A.F.V.R.
Act. Flt. Lt. D. A. G. ANDREWS, R.A.F.V.R., No. 467 (R.A.A.F.) Sqn.
Act. Flt. Lt. J. A. ARMOUR, D.F.M., R.A.F.V.R., No. 50 Sqn.
Act. Flt. Lt. G. BELL, R.A.F., No. 9 Sqn.
Act. Flt. Lt. F. P. BURBRIDGE, R.A.F.V.R., No. 97 Sqn.
Act. Flt. Lt. D. H. CHOPPING, R.A.F.V.R., No. 50 Sqn.
Act. Flt. Lt. W. R. HAKE, R.A.F.V.R., No. 467 (R.A.A.F.) Sqn.
Act. Flt. Lt. J. HAY, R.A.F.V.R., No. 12 Sqn.
Act. Flt. Lt. V. G. HOPE, R.A.F., No. 158 Sqn.
Act. Flt. Lt. J. A. E. LANCASTER, R.A.F.V.R., No. 429 Sqn.
Act. Flt. Lt. R. MACILWAINE, R.A.F.V.R., No. 7 Sqn.
Act. Flt. Lt. W. H. MALLINSON, R.A.F.V.R., No. 196 Sqn.
Act. Flt. Lt. T. L. MCCANN, R.A.F.V.R., No. 51 Sqn.
Act. Flt. Lt. W. S. MUEGO, R.A.F.V.R., No. 77 Sqn.
Act. Flt. Lt. D. B. SMITH, R.A.F.V.R. No. 78 Sqn.
Act. Flt. Lt. J. T. SMITH, R.A.F.V.R., No. 156 Sqn.

Distinguished Flying Medal

Flt. Sgt. R. K. BAGGS, R.A.F.V.R., No. 97 Sqn.
Flt. Sgt. E. C. BAILEY, R.A.F.V.R., No. 166 Sqn.
Flt. Sgt. W. S. BAMLETT, R.A.F., No. 97 Sqn.
Flt. Sgt. N. W. BARNETT, R.A.F., No. 25 Sqn.

Wing Cdr. John Hurry who received the D.S.O. at a recent investiture at Buckingham Palace.

Flt. Sgt. K. BATE, R.A.F.V.R., No. 207 Sqn.
Flt. Sgt. J. L. R. BAKER, R.A.F.V.R., No. 97 Sqn.
Flt. Sgt. D. W. CHARD, R.A.F.V.R., No. 429 Sqn.
Flt. Sgt. I. J. COPPING, R.A.F.V.R., No. 12 Sqn.
Flt. Sgt. R. S. CRADDOCK, R.A.F.V.R., No. 101 Sqn.
Flt. Sgt. K. G. DAVIS, R.C.A.F., No. 83 Sqn.
Flt. Sgt. T. G. DILL, R.N.Z.A.F., No. 75 (N.Z.) Sqn.
Flt. Sgt. (now P/O.) R. DUBOIS, R.C.A.F., No. 166 Sqn.
Flt. Sgt. S. J. ELDRIDGE, R.A.F.V.R., No. 50 Sqn.
Flt. Sgt. A. C. W. FUSSELL, R.C.A.F., No. 78 Sqn.
Flt. Sgt. B. E. GALE, R.A.F.V.R., No. 166 Sqn.
Flt. Sgt. G. C. GRANGER, R.A.F.V.R., No. 97 Sqn.
Flt. Sgt. (now P/O.) W. E. J. HARRIS, R.A.F.V.R., No. 7 Sqn.
Flt. Sgt. R. J. G. HARRISON, R.A.F.V.R., No. 619 Sqn.
Flt. Sgt. L. W. HITCHINS, R.N.Z.A.F., No. 196 Sqn.
Flt. Sgt. W. T. HOLLINGS, R.A.A.F., No. 460 (R.A.A.F.) Sqn.
Flt. Sgt. R. F. HUGHES, R.C.A.F., No. 76 Sqn.
Flt. Sgt. W. H. HUGHES, R.A.F.V.R., No. 102 Sqn.
Flt. Sgt. S. E. LAINCHBURY, R.A.F.V.R., No. 7 Sqn.
Flt. Sgt. W. LUMSDEN, R.A.F.V.R., No. 427 (R.C.A.F.) Sqn.
Flt. Sgt. C. P. MIDDLETON, R.A.F.V.R., No. 101 Sqn.
Flt. Sgt. E. H. F. MOORE, R.A.F.V.R., No. 619 Sqn.
Flt. Sgt. (now P/O.) T. V. MORGAN, R.A.A.F., No. 460 (R.A.A.F.) Sqn.
Flt. Sgt. S. H. A. NEILL, R.A.F.V.R., No. 97 Sqn.
Flt. Sgt. G. J. OAKESHOTT, R.A.A.F., No. 460 (R.A.A.F.) Sqn.
Flt. Sgt. A. J. C. PEGRUM, R.A.F.V.R., No. 207 Sqn.
Flt. Sgt. J. PRENDERGAST, R.A.F.V.R., No. 9 Sqn.
Flt. Sgt. E. A. PULLINGER, R.A.F.V.R., No. 7 Sqn.

Foreign Decorations

The KING has granted unrestricted permission for the wearing of the undermentioned decorations, conferred upon the officers and airmen indicated, in recognition of valuable services rendered in connection with the war:—

Conferred by the President of the United States of America

Legion of Merit (Officer)

Air Comdre. S. WALLINGFORD, R.N.Z.A.F.

Distinguished Flying Cross

Wing Cdr. J. M. W. ST. PIERRE, R.C.A.F.
Sqn. Ldr. N. F. VINCENT, D.F.C., R.A.A.F.

Air Medal

Flt. Sgt. A. B. DOWNING, D.F.M., R.A.F.
Sgt. J. T. LYONS, D.F.M., R.A.F.

Roll of Honour

Casualty Communiqué No. 329.

THE Air Ministry regrets to announce the following casualties on various dates. The next of kin have been informed. Casualties "in action" are due to flying operations against the enemy; "on active service" includes ground casualties due to enemy action, non-operational flying casualties, fatal accidents and natural deaths.

Of the names in this list, 98 are second entries giving later information of casualties published in earlier lists.

Royal Air Force

KILLED IN ACTION.—Sgt. P. L. Emms; Flt. Lt. A. G. Osmand; Sgt. G. G. Provis; Sgt. H. Ward.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. L. C. Wheeler.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. W. A. H. Ball; Sgt. E. T. Beney; Sgt. L. R. Bray; Sgt. S. J. Briffett; Sgt. R. C. Burt; Flt. Sgt. A. W. Coley; Sgt. J. Cope; Sgt. E. W. Cox; Sgt. P. G. F. Day; Sgt. L. Edwards; Sgt. W. G. Goode; Sgt. R. S. Guy; F/O. T. G. Hackney; Sgt. E. Hodgson; Sgt. G. D. L. Humphreys; Sgt. H. Jowitt; Sgt. J. Linacre; Sgt. R. A. McLaren; Sgt. G. Moses; P/O. F. Noon; Sgt. G. A. Palmer; Flt. Sgt. J. H. Pellowe; Sgt. H. J. Read; F/O. R. L. Reily; Sgt. W. A. Rogers; P/O. E. J. Stanton; Sgt. W. H. Trotter; Sgt. D. W. Turner; Sgt. W. A. Wilkinson; Sgt. W. A. Wilson.

WOUNDED OR INJURED IN ACTION.—Sgt. V. R. Biggerstaff; Sgt. G. S. Broome; Sgt. R. S. M. Brown; Sgt. A. Burkinshaw; W/O. D. R. Fieldhouse; Flt. Sgt. H. O. Humphries; Sgt. H. Proctor; F/O. A. J. Wright.

MISSING, BELIEVED KILLED IN ACTION.—F/O. R. S. Ball; Flt. Sgt. J. H. Frewer; P/O. L. O. Noll; Sgt. J. L. Parry; P/O. D. A. Routen, D.F.M.; Sgt. B. H. Scudder; Flt. Sgt. J. T. Simpson; P/O. C. Wolstenholme; Flt. Sgt. G. Woodcock.

MISSING.—Sgt. H. Austin; Sgt. J. E. H. Bird; Sgt. F. L. Boucher; Flt. Sgt. I. C. R. Bowden; Flt. Sgt. A. C. Branch, D.F.M.; Sgt. S. W. Bridgman; Sgt. H. L. Brittain; Sgt. S. C. Bybee; Sgt. W. G. Cane; Sgt. A. W. Chandler; P/O. A. W. Chubb; Flt. Sgt. A. Clark; Act. Sqn. Ldr. A. G. A. Cochrane, D.F.C.; Sgt. L. F. Comer; Sgt. H. J. Crawford; Sgt. L. Cross; Sgt. W. Crouch; Sgt. J. W. Cummings; W/O. B. B. Davidson; Sgt. A. H. Davies; Sgt. L. Davis; Sgt. L. J. Dawkins; Sgt. R. E. Daye; Sgt. F. Earnshaw; Flt. Sgt. A. G. Emery; Sgt. A. K. Emery; Sgt. J. W. Emson; Sgt. L. English; Flt. Sgt. A. E. Evans; Sgt. D. R. Feely; Sgt. G. P. Finlay; Flt. Sgt. C. W. Foster; Sgt. L. G. E. Gee; Flt. Sgt. E. H. Gibbon; Sgt. C. Gibbons; W/O. W. E. Goldspink; Sgt. J. G. Hagan; Flt. Sgt. W. J. Hall; Sgt. W. Hartley; Flt. Sgt. A. J. Holden; F/O. M. H. Horkheimer; Sgt. W. Howes; Flt. Sgt. H. N. Jones; Sgt. H. W. R. Kerslake; Sgt. G. W. Laybourn; Flt. Sgt. P. E. Lee; Flt. Sgt. T. W. Lewis; P/O. A. Livesey; Sgt. D. Lucas; Sgt. J. C. MacLean; Sgt. J. S. McClean; Sqn. Ldr. R. J. Manton; Flt. Sgt. B. H. Marshall; Sgt. T. O'M. Mears; Sgt. R. H. Morel; Sgt. W. G. Morgan; Sgt. J. R. Murray; Sgt. J. P. Neville; Sgt. W. J. Patterson; Sgt. P. H. Payne; Sgt. F. G. Peplow; P/O. H. C. G. Piper; Sgt. J. Ramsden; P/O. S. J. Slade; Flt. Sgt. C. A. Simmons; Sgt. C. D. Sims; Sgt. C. D. L. Stewart; P/O. A. W. Stringer; Sgt. H. Sykes; Flt. Sgt. R. L. Taylor; Sgt. H. H. Thomas; Sgt. H. E. Thompson; F/O. D. Watson; Flt. Sgt. G. L. Watts; W/O. J. Wells; Flt. Sgt. E. H. Willcocks; Sgt. C. H. M. Wilson; F/O. T. G. Wilson; Flt. Sgt. C. J. Withers; F/O. P. M. Wooldridge; Sgt. G. W. Wooley; Sgt. C. E. Young; Sgt. T. B. Young.

KILLED ON ACTIVE SERVICE.—Sgt. A. Bowyer; F/O. F. W. Brown, D.F.M.; Act. Sqn. Ldr. P. G. Cooper; Flt. Sgt. E. G. Cunliffe; L.A/C. W. E. Elliott; P/O. D. W. Hanham; W/O. G. F. Hardy; F/O. J. R. Hutchison; Sgt. T. Inman; Sgt. C. Johnson; Flt. Sgt. S. A. Millen; Flt. Sgt. D. Mudd; F/O. E. G. W. Nash; F/O. H. J. O'Gara; Sgt. A. G. Oliver; Flt. Lt. E. A. Powrie; Sgt. R. C. Reid; A/C.2 W. G. Richards; Flt. Sgt. K. E. Scammell; Sgt. R. L. Small; L.A/C. E. D. H. Smith; Sgt. M. E. Stellig; Sgt. L. E. Taylor; L.A/C. S. G. Taylor.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—F/O. W. H. Donald.

WOUNDED OR INJURED ON ACTIVE SERVICE.—L.A/C. V. Alexander; Sgt. W. M. Bowyer; Sgt. G. W. Milne; Sgt. A. J. Taylor.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—Sgt. H. P. D. Charlton; Sgt. L. E. Hance.

DIED ON ACTIVE SERVICE.—L.A/C. G. Barnett; A/C.1 F. G. Bell; A/C.1 R. Brown; Cpl. D. Bryson; A/C.2 N. N. Carr; A/C.1 K. F. L. Cole; Sgt. P. Croft; L.A/C. S. J. Crook; Act. Flt. Lt. M. D. Evans; L.A/C. K. A. Foale; A/C.1 V. F. W. C. Forward; L.A/C. L. W. Frowd; A/C.1 A. E. Gammage; L.A/C. W. Hair; L.A/C. T. E. Jones; Sgt. A. W. L. Knight; Sgt. P. Lavelle; A/C.1 D. I. J. Lawrence; Wing Cdr. J. E. M. MacCallum; Cpl. H. D. McKay; F/O. I. MacKenzie; A/C.2 W. Parker; Cpl. G. W. Pedge; L.A/C. J. Robertshaw; L.A/C. P. Whitbread; Cpl. G. W. L. Witherington.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—Sgt. G. Adams; Sgt. E. J. W. Blackler; Sgt. L. W. Booth; Sgt. W. E. Cole; F/O. K. F. East, D.F.M.; Sgt. F. Hugo; Sgt. S. H. Hutton; F/O. B. C. Ings; Sgt. H. Pettie; Flt. Sgt. J. E. C. Simpson; Flt. Sgt. J. M. J. Smith, D.F.M.; W/O. B. H. Travell; Flt. Sgt. E. E. Weare; Flt. Sgt. J. Wilson.

Women's Auxiliary Air Force

DIED ON ACTIVE SERVICE.—Cpl. J. N. Lewis; A/CW.2 M. R. Prosser.

Royal Australian Air Force

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. H. J. Ross; Flt. Sgt. R. C. Stuart.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. P. L. Boase; Sgt. R. J. Booth; W/O. R. Gooding; Flt. Sgt. R. E. H. Hope; P/O. J. G. Lee; Act. Sqn. Ldr. K. Moore, D.F.C.; F/O. K. J. Murphy; Sgt. J. E. Parkes; W/O. W. B. Ran-Claud; F/O. B. K. Rust; Flt. Sgt. J. M. Williams.

SERVICE AVIATION

WOUNDED OR INJURED ON ACTIVE SERVICE.—F/O. F. Hirst.

MISSING.—F/O. E. A. Harris; Flt. Sgt. V. E. Lawson; P/O. B. L. Negus; Flt. Sgt. R. A. Nield; Flt. Sgt. G. S. Read.

KILLED ON ACTIVE SERVICE.—F/O. G. W. Bigmore; W/O. E. G. Clarke; F/O. D. Z. Pile.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—Sgt. N. F. Conklin; Sgt. C. R. Craven; P/O. E. D. P. Every; Flt. Sgt. Siooke.

Royal Canadian Air Force

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. F. H. Blake; Sgt. R. M. Costello; Flt. Sgt. G. R. Gowling; Sgt. A. S. Green; F/O. R. J. Keyes; Flt. Sgt. J. F. J. P. Prieur; Flt. Sgt. R. Webber.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Flt. Lt. R. H. Bertran, D.F.C.; Act. Flt. Lt. W. A. Black; P/O. A. Carruthers; Flt. Lt. D. J. Curtin, D.F.C.; P/O. F. L. E. Dupre; Flt. Sgt. D. C. Lisson; F/O. D. J. MacPherson; Sgt. G. D. Murray; Sgt. D. J. Navin; Sgt. G. F. J. Phalempin; Sgt. A. C. Porter; Sgt. D. V. Prosser; Sgt. O. H. Sibson; Flt. Sgt. L. G. Smith; Flt. Sgt. H. W. Stewart; Sgt. H. V. Thompson; F/O. R. J. Turp; P/O. R. A. Weese.

MISSING, BELIEVED KILLED IN ACTION.—F/O. W. G. Bellinger.

MISSING.—F/O. S. K. Atkinson; Flt. Sgt. F. C. Boulter; Sgt. E. M. Cockin; Flt. Sgt. L. F. Cook; F/O. G. E. Donaldson; F/O. W. J. Erly; P/O. C. V. Galavan; Flt. Sgt. W. M. Gorman; P/O. W. A. Grant; P/O. A. Harrison; Act. Sqn. Ldr. L. E. Logan, D.F.C.; P/O. S. H. Long; F/O. J. C. Lowther; Flt. Sgt. W. D. Miller; F/O. B. A. St. Louis; P/O. J. R. Symons; F/O. T. D. Trippe.

KILLED ON ACTIVE SERVICE.—Sgt. J. M. Allen; Sgt. A. J. Duhamel; Sgt. R. J. Dunnigan; F/O. F. H. Grainger; Sgt. J. H. Hodgson; Sgt. V. H. Louis; Sgt. J. J. M. P. Marchessault; Sgt. J. G. A. G. Meilleur; P/O. J. A. L. Morissette; Sgt. R. H. Murphy; W/O. G. Smith; F/O. D. L. Sproule; P/O. G. A. Wallace.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Sgt. C. C. Shook; Sgt. M. B. Valette.

DIED ON ACTIVE SERVICE.—Sgt. T. W. Draper.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—F/O. W. J. Markowsky.

Royal New Zealand Air Force

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. R. C. Anderson.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. C. A. Foster; Sgt. W. H. Sloan.

MISSING.—P/O. R. L. Baker; Flt. Sgt. R. J. Farrelly; Act. W/O. A. H. Pargeter.

KILLED ON ACTIVE SERVICE.—P/O. D. P. Kyne.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—F/O. C. F. P. Brown; Flt. Sgt. W. I. Hansen.

South African Air Force

KILLED IN ACTION.—Flt. Sgt. J. A. Burgh.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Capt. M. Currie.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—Lt. G. W. Barnes.

Casualty Communiqué No. 330.

Of the names in this list 101 are second entries giving later information of casualties published in earlier lists.

Royal Air Force

KILLED IN ACTION.—Sqn. Ldr. L. F. Cooper; F/O. D. G. Evans; Sgt. J. Murphy.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—P/O. D. H. G. Adams; F/O. C. R. M. Bell; Sgt. F. M. Chaffey; Sgt. A. P. Deighton; P/O. J. B. Denton; Sgt. R. C. M. Douglas; Sgt. P. Grimwood; Flt. Sgt. M. Harrison; Sgt. R. A. Harvey; Sgt I. B. Inglis; Sgt. L. F. W. Jones; Sgt. G. H. Lawson; Sgt. A. Luke; Sgt. K. F. Neville; Sgt E. C. P. Newton; Sgt. T. Pearson; Sgt. N. P. Plenderleith; Sgt. W. M. Rimsecha; Sgt. A. W. A. Robinson; Act. Flt. Lt. M. F. Taylor; Sgt. A. E. Wallis; Sgt. H. J Warburton; Sgt R. Watson; Sgt. J. B. Watt.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. W. E. Akrill; P/O. D. I. Arthur; Sgt. J. C. Aston; Sgt. R. Bee; Act. Flt. Sgt. D. B. Bourns; Sgt. F. Butterfield; Act. Flt. Sgt. T. R. Cairns; P/O. C. D. Calvert, D.F.M.; Sgt. J. K. Campbell; F/O. D. I'A. Cartwright; P/O. T. W. Challoner; F/O. J. W. Coleman; Sgt. L. G. Collings; Sgt. T. B. Colwell; Flt. Sgt. R. F. Cooksey; Sgt. G. S. Cooper; Sgt. K. Coulson; Sgt. D. R. Edwards; Sgt. A. K. Eley; Sgt. L. P. Fallon; Sgt. L. G. Freeman; Sgt. R. C. Frost; Sgt. F. P. C. Gower; Sgt. W. A. Griffiths; Sgt. R. Harrison; Flt. Sgt. S. A. Hathaway; Sgt. A. Holt; Sgt. G. M. Inness; Sgt. A. Jenkinson; Sgt. R. A. Johnston; Act. Flt. Lt. R. L. Knowles; Sgt. C. J. J. W. Lamb; Sgt. F. E. Lee; Sgt. H. Lloyd; P/O. G. MacKay; Sgt. W. C. Marsh; Sgt. R. W. Mason; Sgt. F. C. W. Michell; Sgt. D. A. Nunn; Sgt. R. O'Brien; Sgt. P. Parkin; Sgt. C. G. Parr; Sgt. L. C. Pearson; Flt. Sgt. H. Plant; Sgt. R. F. Poole; Sgt. D. H. Powell; Act. Flt. Lt. L. A. Rickinson, D.F.C.; P/O. J. H. Ridd; Sgt. D. Robb; Flt. Sgt. R. R. S. Rolfe; Sgt. G. Sandfield; Sgt. W. Sharp; Sgt. A. C. Sixsmith; Sgt. E. Smith; Sgt. J. T. Smith; Flt. Sgt. L. R. Smith; Sgt. A. G. Snow; Sgt. N. P

Air Marshal Sir Arthur Coningham, A.O.C. Mediterranean Tactical Air Forces, holds a conference of squadron commanders.

Taylor; Sgt. G. Tombe; Sgt. L. R. Tomlinson; Sgt. J. J. Vaulkhard; Sgt. B. C. J. White; F/O. H. L. Wynne, D.F.M.

WOUNDED OR INJURED IN ACTION.—Sgt. A. Baron.

MISSING, BELIEVED KILLED IN ACTION.—Flt. Sgt. J. C. Adey; Sgt. D. W. Angell; Act. Flt. Sgt. S. T. Athey; Sgt. W. J. Barber; Flt. Sgt. A. R. Brace; Sgt. E. J. Brown; Flt. Sgt. W. K. Brown; P/O. V. J. Chorley; Flt. Sgt. J. F. Craig, D.F.M.; Sgt. D. W. Hall; Sgt. L. R. Hall; P/O. L. Healey; P/O. S. R. Hughes; Sgt. C. Kershaw; Sgt. D. Kirkwood; Sgt. C. J. Lawrence; F/O. W. H. McDowell; Flt. Sgt. H. Millard; Sgt. W. L. Morpeth; F/O. D. W. Owen; F/O. J. W. Payne; Sgt. T. Rawlings; Sgt. R. E. Scott; P/O. C. F. Smith; Sgt. T. K. Wardley; Flt. Sgt. J. S. Whitecross; Sgt. H. R. Wilson; Sqn. Ldr. C. S. F. Wood.

MISSING.—Act. Flt. Lt. C. H. Abbott; Sgt. G. F. Allison; F/O. P. Anderson; Sgt. J. E. Bacon; Sgt. G. H. Bennett; Sgt. G. T. Boswell; F/O. J. R. Brice; Flt. Sgt. P. H. Brown; Sgt. J. Cahill; Sgt. J. B. Cameron; Sgt. W. A. Cassell; Sgt. M. E. Cipriani; Sgt. J. N. Conner; Sgt. J. C. Cowie; Sgt. H. Cowley; Sgt. G. A. Davis; Sgt. T. Deacon; Act. Wing Cdr. R. G. England, D.S.O., D.F.C.; Sgt. A. G. Fisher; Flt. Sgt. J. Foley; Sgt. R. A. Ford; Flt. Sgt. R. Fowler; Flt. Sgt. A. F. Fry; Sgt. N. Gardener; Sgt. R. Gibson; P/O. S. Greenlees; Flt. Sgt. E. Gwynne; P/O. J. W. Hardcastle; Sgt. J. Hardy; Sgt. R. E. Harnett; Flt. Sgt. A. Hodgkinson; Flt. Sgt. T. Hoeg; Sgt. S. F. Hone; Sgt. G. Hood; Sgt. S. H. Hopson; Flt. Sgt. C. B. Jolliffe; P/O. A. E. Kindell, D.F.M.; Sgt. G. T. Kummer; Sgt. T. V. Lewis; F/O. M. Lloyd; Sgt. B. D. S. Lovell; Flt. Lt. A. G. MacLeod, D.F.C.; Act. Sqn. Ldr. K. Mathews; Sgt. P. H. Maudling; Flt. Sgt. T. D. Mayne; Flt. Lt. A. A. Mellor; P/O. K. P. Mills; Flt. Sgt. V. G. Muddell; Act. Flt. Sgt. F. E. Noble; F/O. C. E. Oakley; P/O. E. Painter; Sgt. E. Parker; P/O. G. E. Parkes; F/O. J. P. Phillips; F/O. S. Potts; Sgt. D. R. Radford; Sgt. A. J. G. Richards; Sgt. R. F. Ricketts; Sgt. C. Rodham; Act. Flt. Lt. D. R. Rogers; Sgt. R. Ruddle; P/O. L. A. Seary; Act. Sqn. Ldr. G. A. Sells; Flt. Sgt. F. H. Simmons; P/O. G. Simpson; Sgt. R. S. Sitch; Sgt. P. L. Smith Sgt. D. L. Thornley; P/O. R. A. Thornton; Sgt. J. D. Walton; Sgt. F. Wilkinson; Sgt. M. S. Williams; Sgt. R. O. Williamson; Sgt. H. D. Young.

KILLED ON ACTIVE SERVICE.—Flt. Sgt. V. J. Baker; F/O. E. A. Bater; Sgt. S. F. Cowcher; Sgt. G. E. Glass; Sgt. T. P. Higgins; Sgt. J. F. Lea; Sgt. F. E. Lovegrove; Sgt. A. W. Turpin; Sgt. T. F. Skipp; F/O. J. W. Whitehouse.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Sgt. A. G. E. Clarke; Sgt. D. Fitzmaurice; Sgt. L. C. Kemp; Sgt. R. Leonard; Cpl. S. M. Parks; Sgt. J. A. R. Ware; Sgt. R. Webb; L.A/C. S. Wright.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Flt. Sgt. G. A. Eastaway; Sgt. R. A. Gausden; Act. Sgt. J. Green; Sgt. S. P. Perrett; Sgt. G. A. P. Saunders; L.A/C. H. B. Swailes; L.A/C. C. J. Yendell.

DIED ON ACTIVE SERVICE.—L.A/C. A. Crinkley; L.A/C. C. Crosbie; L.A/C. E. A. Dennis; Act. Flt. Lt. N. H. Dick; L.A/C. A. Green; L.A/C. J. Greer; Sgt. R. W. Lane; Cpl. A. C. Nunn; Sgt. W. Ward.

Royal Australian Air Force

WOUNDED OR INJURED IN ACTION.—Flt. Sgt. S. G. Webster.

MISSING.—Flt. Sgt. S. M. Close; W/O. J. J. Craner; Flt. Sgt. R. S. Kift; F/O. J. W. Leitch; Flt. Sgt. R. H. Watts; Flt. Sgt. R. C. Williams; Flt. Sgt. R. F. Zwar.

KILLED ON ACTIVE SERVICE.—W/O. G. A. Harris; Sgt. L. G. Jones.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—Flt. Sgt. G. T. Duane.

Royal Canadian Air Force

KILLED IN ACTION.—Flt. Sgt. J. A. Deschamps; F/O M. P Northmore; Flt. Sgt. S. A. H. Richards.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. G. McL. Dunn; Flt. Sgt. K. V. Linquist; Flt. Sgt. H. MacD. Martin; Sgt. N. O. Robinson; Sgt. S. M. Thomas; F/O C. W. Woodward.

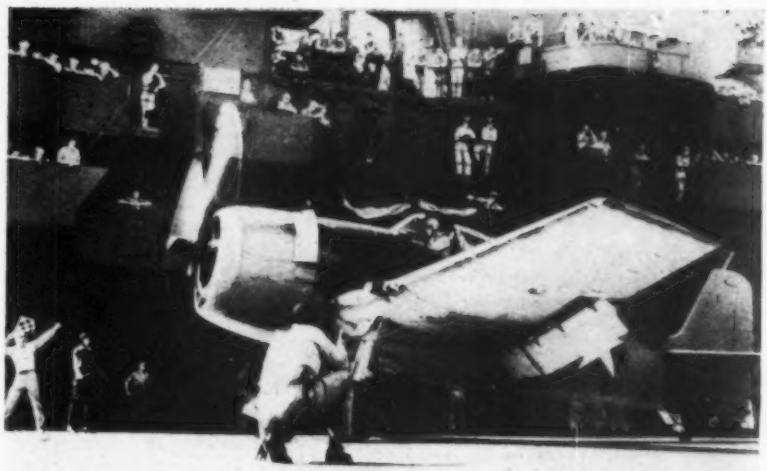
MISSING, BELIEVED KILLED IN ACTION.—Flt. Sgt. W. H. Burton; Act. Wing Cdr. G. A. McMurdy; Flt. Sgt. R. W. Miller; Flt. Sgt. F. W. Peterkin; Flt. Sgt. E. J. C. Plouffe; Flt. Sgt. C. C. Reynolds; F/O. W. S. Sewall; Act. Sqn. Ldr. W. N. Thomson; Flt. Sgt. A. B. Willson; Sgt. A. W. L. Worrad; W/O. F. Yackison.

MISSING.—Flt. Sgt. J. W. Adamson; Sgt. G. E. Aitken; F/O. R. L. Bayard; Sgt. C. P. Brown; Flt. Sgt. F. B. Christenson; Flt. Sgt. W. G. Crain; P/O. H. W. Cudney; P/O. J. J. Dance; Flt. Sgt. H. C. Dixon; Sgt. J. A. C. Dupont; Sgt. D. Durrell; Sgt. M. A. Edwards; F/O. H. P. Farr; Flt. Sgt. J. S. Ferris; Flt. Sgt. F. Guay; Sgt. C. E. Hall; P/O. R. B. Jackson; P/O. W. Kerslake; Flt. Sgt. J. O. A. Lapointe; Sgt. R. O. P. J. McCart; P/O. R. E. McComb; Flt. Sgt. E. T. McDermott; P/O. J. A. M. Nadeau; Sgt. H. Newlove; W/O J. A. Pollock; W/O. R. H. Prest; P/O. A. F. Seances; W/O. F. B. Watson; P/O. L. G. Wilson; Act. Flt. Lt. W. J. Weston; Act. Flt. Lt. A. J. Whiston; Sgt. D. W. Wilson.

KILLED ON ACTIVE SERVICE.—Flt. Sgt. D. J. Cotter; Flt. Sgt. K. Riep.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Sgt. R. F. Middaugh.

DIED ON ACTIVE SERVICE.—Act. Flt. Lt. L. L. Holmes.



A U.S. Navy Hellcat about to take off from an aircraft carrier. The position in relation to the "island" shows the short run required, and the degree of flap used is remarkable.

Royal New Zealand Air Force

WOUNDED OR INJURED IN ACTION.—F/O. L. H. Greenwood.

MISSING, BELIEVED KILLED IN ACTION.—Flt. Sgt. N. K. P. Hickson.

South African Air Force

KILLED ON ACTIVE SERVICE.—2/Lt. Lewis.

Casualty Communiqué No. 331.

Of the names in this list 103 are second entries giving later information of casualties published in earlier lists.

Royal Air Force

KILLED IN ACTION.—Flt. Sgt. H. E. Bruck; Flt. Sgt. J. W. S. Henderson; W/O. F. W. Hutchinson; Sgt. J. W. Jackson; Sgt. T. Morfitt; Sgt. W. R. Myhill; F/O. A. D. Sayle; Flt. Sgt. J. Walker.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Wing Cdr. G. E. MacDonald.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. S. Abel; Sgt. E. Atkins; W/O. J. H. Bailey; Sgt. A. L. Barber; Sgt. J. A. Barnard; Sgt. F. D. Bell; Flt. Lt. I. N. Benard; Sgt. F. W. Boustead; F/O. A. H. Bowler; Sgt. D. Brown; F/O. J. J. W. Burns; Sgt. D. G. Busby; Sgt. T. A. Butt; Sgt. S. E. Cann; Sgt. F. W. Cater; F/O C. E. Chapman; Sgt. K. W. Chipchase; Sgt. R. Clark; Sgt. T. Cosford; Sgt. E. Couldwell; P/O. B. A. Curtis; Sgt. C. Davies; Flt. Sgt. J. W. A. Dorsett; Flt. Lt. W. A. S. Elder, A.F.C.; Sgt. C. V. Ellen; Sgt. J. Ferguson; P/O. J. I. P. Ford; F/O. W. H. Franklin; Sgt. B. R. Fyfield; Sgt. A. Greig; Sgt. H. C. Griffin; Sgt. C. M. Harrower; P/O. J. W. Hawkes; Flt. Sgt. W. J. Hilton; Sgt. D. T. Hodgson; Sgt. A. Innes; Sgt. G. H. James; Sgt. K. R. Johnson; Sgt. P. Johnson; Sgt. H. R. Jones; Sgt. J. H. Jones; Sgt. J. Kennedy; P/O. J. C. Kenworthy; Sgt. J. B. Lewis; Sgt. W. G. Ludbrook; Flt. Sgt. A. Lynch; F/O. G. H. McMillan; Sgt. D. McNeill; P/O. G. McWilliam; Flt. Sgt. T. H. Miller; P/O. V. A. Nono; Flt. Lt. P. Parnham, D.F.C.; P/O. G. Percy; Sgt. E. N. Perkins; P/O. S. Plaskett; P/O. A. R. Potter; Sgt. R. Rawcliffe; Sgt. R. G. Riley; Sgt. R. E. Sackville-Golden; Flt. Sgt. R. Shears; Sgt. A. Simmons; Sgt. A. J. Sinclair; F/O. J. C. Smith; Sgt. A. C. Spear; P/O. R. Sword; Sgt. A. B. Tarrant; P/O. J. R. Thompson; Sgt. N. F. Trigg; Sgt. B. C. Trivitt; Sgt. W. A. Vesely; Sgt. A. Watson.

PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED IN ACTION.—Flt. Sgt. E. F. Bass; Act. Flt. Lt. F. B. Birmingham; P/O. C. S. Holter; Sgt. C. Kincaid; Sgt. A. Longstaffe; Flt. Sgt. H. Sloan.

WOUNDED OR INJURED IN ACTION.—Sgt. S. S. Banfield; Sgt. W. M. Bissett; Sgt. G. C. Pounder.

DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—Flt. Sgt. R. Bugge.

MISSING, BELIEVED KILLED IN ACTION.—Sgt. R. J. Darby.

MISSING.—F/O. M. MacL. Adam; Sgt. J. McI. Anderson; F/O. F. G. Arliss; Sgt. A. Bailey; Sgt. R. A. Bell; Sgt. N. G. Boxshall; Flt. Sgt. H. Brennand; Sgt. R. L. Brunton; Sgt. B. L. Bryant; Sgt. J. S. Carnill; Flt. Sgt. D. C. Carter; F/O. L. G. Crane; Sgt. J. A. Cullen; Sgt. K. J. Davis; Sgt. D. Drury; Flt. Sgt. W. A. Eacott; Sgt. W. F. Ellis; Sgt. F. A. Erwood; Sgt. A. Evans; Sgt. F. A. J. Fewson; Sgt. S. W. Garbutt; Sgt. R. W. Glover; F/O. J. F. L. Hagan; Sgt. B. H. Hall; P/O. R. S. Haney; P/O. R. F. Hayward; Sgt. B. H. Horscroft; Sgt. S. Jones; Sgt. G. E. Kendall; Sqn. Ldr. R. A. Lenton, M.C., D.F.C.; Sgt. H. MacAulay; Sgt. W. D. Paul; Flt. Sgt. L. Porter; Sgt. A. R. Preston; P/O. W. B. Pritchard; Sgt. R. N. Reeves; Sgt. P. Shaw; F/O. D. W. Steeper; Sgt. R. E. Stokes; Sgt. T. H. Tibbles; Sgt. E. Walker; F/O. W. Wilson; Sgt. J. Woolman; F/O. R. S. Yeadon.

KILLED ON ACTIVE SERVICE.—Sgt. L. M. Amesbury; L.A/C. N. W. Armstrong; Sgt. G. G. Batten; F/O. P. C. Bell; Sgt. J. S. Buchan; Sgt. E. W. Camp; L.A/C. W. W. Chamberlain; Sgt. R. M. Clark; Cpl. R. G. H. Clarke; Sgt. D. A. R. Colegate; Act. Flt. Lt. I. H. Courtney; F/O. M. R. J. Crutcher; Sgt. E. F. Davany; Sgt. D. Dickson; L.A/C. M. V. Eckert; F/O. A. M. Fitzrandolph; P/O. V. Gerrard; Sgt. L. M. Griffiths; P/O. G. P. Hewson; Sgt. R. G. Huntspage; Flt. Lt. M. W. Kinmouth, D.F.C.; Act. Sqn. Ldr. T. J. R. Lawman; L.A/C. G. E. Lyons; Flt. Sgt S. J. McLaughlin; Sgt. E. J. McMillan; L.A/C. J. Major; P/O. G. D. Mason; F/O C. Mitchell; Sgt. T. B. Nugent; Sgt. J. H. Paterson; Sgt. R. D. Phillips; Sgt. E. Povey; Act. Flt. Lt. R. Y. Rodger; L.A/C. F. H. Royle; Sgt. J. L. Silver; Sgt. A. J. Smith; Flt. Sgt. L. Smith; F/O J. L. Stalker; Sgt. B. H. Thompson; Sgt. P. J. Walsh; Sgt. P. O. Walsh; Flt. Sgt. D. J. Warner, Sgt. R. L. Warren; Sgt. L. H. Wildman; Sgt. R. Wilson; Flt. Sgt. S. B. Wilton; Sgt. R. C. S. Young.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Sgt. J. E Blount; L.A/C. I. W. Jones; A/C 2 A. E. Osbourne.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—Sgt. C. G. Evans; F/O. H. J Green; L.A/C. A. R. Lewis; P/O. H Lowcock; L.A/C. E. L. Markham; F/O. F. A. Mellors.

DIED ON ACTIVE SERVICE.—Cpl. H. G. Bowers; L.A/C. T. C. Bradbrook; A/C.1 E. J. Brench; L.A/C. C. Brierley; L.A/C. S. G. Challenger; A/C.1 R. E. A. Furze; A/C.1 A. Gillard; Cpl S. G. Greaves; Cpl. G. K. Gresty; Wing Cdr. A. L. Grice; A/C.2 R. A. Hall; A/C.1 H. R Hunt; A/C.1 R. Lambeth; L.A/C. F. Martin L.A/C. R. W. J. Stokes; P/O. P. R. Wood.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—Sgt. S. J. Maxted Wing Cdr. T. A. B. Parselle; Sgt. F. Sanders Sgt. J. S. Wilkins.

Women's Auxiliary Air Force

KILLED ON ACTIVE SERVICE.—Cpl. J. C. R Hayes.

DIED ON ACTIV. SERVICE.—L.A/CW. L. O. Edwards.

Royal Australian Air Force

KILLED IN ACTION.—F/O. H. L. Van Zuilcom; F/O. G. W. Waugh.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. R. F. Cripps; P/O. W. L. Gibbs; P/O. E. J. Gleeson; Sgt. A. G Wilson.

PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED IN ACTION.—Flt. Sgt. B. A. O'Hara.

WOUNDED OR INJURED IN ACTION.—Flt. Sgt E. W. M. Trigwell.

MISSING, BELIEVED KILLED IN ACTION.—Flt Sgt. J. C. De B. Dow; Act. Flt. Lt. L. G. Knight

MISSING.—F/O. A. M. Davey; Flt. Sgt. J. Gilvarry; Flt. Sgt. J. Joiner; Flt. Sgt. J. A. H

SERVICE AVIATION

May; Flt. Sgt. D. S. Nest; W/O. J. R. Power; Flt. Lt. G. Sweeney.

KILLED ON ACTIVE SERVICE.—Sgt. S. B. Cribb; Flt. Sgt. T. C. Elstub; Flt. Sgt. A. J. Gallagher; Sgt. K. Gehrmann; Sgt. N. C. Hanson; Sgt. J. J. Herbert; Sgt. A. H. Hines; F/O. F. R. Jackson; Flt. Sgt. A. S. Johnston; Flt. Sgt. H. I. Jones; P/O. T. T. Jones; Flt. Sgt. S. S. L. La Frentz; F/O. D. A. McKechnie; P/O. M. E. McKiggan; F/O. J. W. Morton; Flt. Sgt. F. G. Neville; Flt. Sgt. G. H. Sansome; F/O. O. I. H. Stoeckel.

DIED ON ACTIVE SERVICE.—W/O. H. G. Murray.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—Act., Air Comdre. D. E. L. Wilson.

Royal Canadian Air Force

KILLED IN ACTION.—Flt. Sgt. R. F. Smith.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. F. H. Barrett; Flt. Sgt. L. H. Jordan; P/O. B. H. Labarge; Flt. Sgt. W. B. Stauble.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. E. H. Bakeman; Flt. Lt. J. G. Bamford; Sgt. A. J. Down; Sgt. W. H. George; Sgt. D. H. Miller; Sgt. C. R. Peacock; Sgt. T. W. Telfer.

PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED IN ACTION.—W/O. J. J. Kunz; Flt. Sgt. G. E. Rozell.

MISSING.—Act. Sqn. Ldr. C. W. L. Hulke; Flt. Lt. R. H. B. Jackson; F/O. M. C. Murray.

MISSING, BELIEVED KILLED ON ACTIVE SERVICE.—Sgt. M. P. Loyst.

KILLED ON ACTIVE SERVICE.—P/O. H. H. Barton; P/O. G. J. Gallagher; W/O. N. W. Gardner; Sgt. A. L. Jacobs; Sgt. C. R. G. Long; P/O. J. H. Magnes; P/O. W. D. Newel; Sgt. A. J. O'Neill; P/O. H. O. Seifert.

Royal New Zealand Air Force

KILLED IN ACTION.—Flt. Sgt. P. M. East; Flt. Sgt. J. R. Randle.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. T. S. E. Bennett; Sgt. J. K. Wilkins.

MISSING.—Flt. Sgt. M. C. Baynes; Flt. Sgt. R. C. Cornfoot.

KILLED ON ACTIVE SERVICE.—Flt. Sgt. S. C. Corby; Sgt. T. B. Tanner.

South African Air Force

MISSING.—Lt. C. M. D. Booysen; 2/Lt. J. F. Cameron; Lt. I. M. Meiring; Flt. I. H. Potgieter; Lt. R. M. Ruler.

Casualty Communiqué No. 332.

Of the names in this list, 122 are second entries giving later information of casualties published in earlier lists.

Royal Air Force

KILLED IN ACTION.—Sgt. W. F. A. Baillie; P/O. R. Cameron; Sgt. S. Eyre; Act. Flt. Lt. R. J. Fielder; Flt. Lt. J. Gordon, D.F.C.; F/O. R. G. Hayes, D.F.C.; Sgt. J. Hutton; Flt. Sgt. R. A. Tann; Sgt. S. Underwood; Sgt. A. N. Williamson.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. W. T. Allen; Sgt. A. Brotherton; Sgt. A. R. Cardoe; Sgt. J. J. Chandler; Sgt. A. L. Fisher; Sgt. N. Lagna.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. W. H. D. Alison; Sgt. H. N. Balmforth; Flt. Sgt. M. E. Barker; Sgt. H. L. Barnes; Sgt. E. P. G. Bayliss; Flt. Sgt. W. H. Beaver; Sgt. C. A. Bell; Sgt. E. Bell; Flt. Sgt. G. Bell; Sgt. E. W. J. Bennett; Sgt. R. T. Bozier; Flt. Lt. J. A. Bright; Sgt. R. W. Brodie; P/O. T. H. Brown; F/O. J. R. Bullock; F/O. A. H. Bywater; Sgt. A. Campbell; Sgt. T. N. Chadwick; Sgt. C. F. Clout; Sgt. R. A. Collins; Sgt. H. Coupe; Sgt. D. Cowie; Sgt. W. G. Creed; F/O. J. M. Cremer; Sgt. R. F. Cunningham; Sgt. J. W. Denby; Sgt. R. E. Dignum; Sgt. J. P. Duffy; F/O. A. F. J. Duncan; Sgt. K. T. Dutton; Sgt. S. Ellam; Sgt. G. Fisher; Sqn. Ldr. W. Fletcher, D.F.C.; Sgt. K. Foster; Sgt. W. G. Garratt; F/O. B. A. A. Geale; Sgt. D. W. Glover; Sgt. E. G. Goodfellow; Sgt. J. W. Grant; Sgt. T. J. Gregory; Sgt. G. H. Hale; Sgt. W. Halliday; F/O. J. F. Harris; Flt. Lt. C. K. Hayden; Sgt. J. W. Hearn; Sgt. R. W. Hodge; F/O. J. S. Holmes, D.F.C.; P/O. R. Hoos; Sgt. H. Hope; Sgt. J. H. Howorth; F/O. P. T. Howson; Sgt. R. T. A. Hudson; Sgt. E. W. Inwood; Sgt. N. Jones; Sgt. K. S. Keeble; Sgt. J. G. Kennedy; Sgt. R. Kennedy; Sgt. E. F. Kinerman; Sgt. C. L. King; Flt. Sgt. L. Knill; Sgt. R. L. Laycock; Sgt. G. K. Leighton; Flt. Sgt. J. T. Lindsay; Sgt. G. A. Lloyd; Act. Flt. Lt. P. S. C. Lovelace; P/O. L. R. S. Luton; Flt. Sgt. J. McAllister; Sgt. D. McCardle; Sgt. J. McCormack; Sgt. M. D. McHale; Sgt. R. McKerrell; Sgt. T. E. Mackrill; Act. Flt. Sgt. R. L. Merrett; Sgt. W. J. Merrigan; Sgt. J. I. Mitchell; Flt. Sgt. R. Moorin; Sgt. H. J. Moss; Sgt. L. Nash; Sgt. H. D. Newberry; Sgt. J. R. Oliver; Sgt. D. W. Penney; Sgt. T. Penrose; Sgt. J. Piggott; Sgt. F. R. Pym; Sgt. E. A. Rolfe; P/O. H. Rowson; Sgt. R. Scott; Sgt. D. C. Smith; Sgt. J. C. Smith; Sgt. F. T. Spivey; Sgt. H. R. Stevenson; Flt. Sgt. C. Stewart, D.F.M.; P/O. A. J. Stuart; Sgt. A. Tannock; Sgt. A. M. Taylor; Flt. Lt. F. D. J. Thompson; Act. Sqn. Ldr. M. E. Thwaites, D.F.C.; Sgt. J. R. S. Waller; F/O. P. R. Ward; Sgt. H. V. Werner; Sgt. N. Young.

PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED IN ACTION.—Flt. Sgt. J. Berry.

WOUNDED OR INJURED IN ACTION.—F/O. C. D. Catley; Sgt. J. W. Norris; Act. Flt. Lt. W. Reid; Sgt. H. H. Turner.

DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—Flt. Sgt. J. J. Mann; Sgt. J. Winstanley.

MISSING, BELIEVED KILLED IN ACTION.—Sqn. Ldr. A. V. Gowers, D.F.C.; F/O. P. T. R. Mercer; Sgt. G. C. Robinson; F/O. B. H. Steele; Sgt. W. Turnbull.

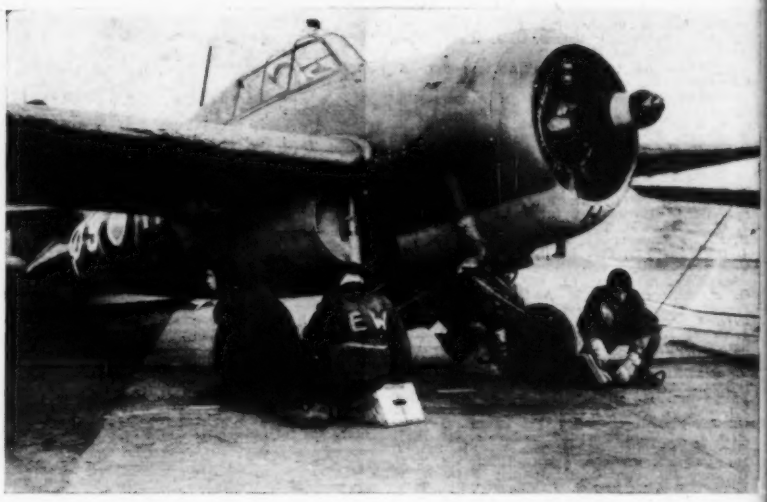
MISSING.—Flt. Sgt. S. B. Adams; Act. W/O. B. E. E. Allden; Sgt. M. R. Armstrong; F/O. R. L. H. Ball; Flt. Sgt. A. J. Beaumont; Sgt. F. Brown; Sgt. J. A. Buck; Sgt. R. T. Burman; P/O. P. E. Camille; Sgt. R. Chambers; Flt. Sgt. R. Charlton; Sgt. T. J. Colston; F/O. J. Dixon; Flt. Sgt. C. D. B. Dubery; Act. Flt. Lt. L. W. D. Fagan, D.F.C.; Flt. Sgt. L. J. Garrow; Sgt. L. C. Gaskins; F/O. L. C. Gilding; Flt. Sgt. R. Gittus; Sgt. J. Grainger; Sgt. A. H. Haworth; P/O. J. W. Heppell; F/O. F. Hewitt; Sgt. J. B. Hunter; Sgt. L. C. James; Flt. Sgt. R. L. Jenkins; Sgt. H. Kearsley; F/O. P. G. Keogh; F/O. W. R. King; P/O. C. F. Knapp; Sgt. D. N. Lambert; Flt. Sgt. K. Lomas; Sgt. J. Lusby; Flt. Lt. I. F. McDermont; Sgt. W. J. B. McNaught; Sgt. C. L. Manuel; P/O. D. Miller; Sgt. G. A. Nelson; Sgt. C. F. Parmenter; Sgt. S. W. Parr; Sgt. G. W. Priest; Flt. Sgt. J. L. Richards; Sgt. A. Robertson; Sgt. A. E. Shaw; Sgt. J. Shepherd; Sgt. F. J. Smith; P/O. D. H. Spencer; W/O. G. H. Stevens; Sgt. R. Stratton; F/O. J. Strickland; Sgt. J. F. Stubbington; Flt. Sgt. G. B. Taylor; F/O. G. A. Terry; F/O. P. W. B. Timms; F/O. D. R. Walton; F/O. H. White; Act. Flt. Lt. H. H. V. Wilkinson.

MISSING, BELIEVED KILLED ON ACTIVE SERVICE.—Flt. Sgt. K. A. Alexander; Sgt. T. Ashcroft; Sgt. L. C. Cockren; Flt. Sgt. W. L. Jones.

KILLED ON ACTIVE SERVICE.—P/O. A. J. N. Berry; Sgt. D. Clarke; L.A/C. W. Claypole; Sgt. P. A. Collins; L.A/C. J. T. Cuthbertson; L.A/C. D. Elliott; Sgt. J. J. J. Fisher; Sgt. N. S. Forbes; Sgt. J. G. Gray; Sgt. H. T. Green; Sgt. M. W. Hallam; Sgt. I. Hayward; Sgt. H. L. Hembrough; Flt. Sgt. J. V. B. Homewood; W/O. T. F. Jefferson; Sgt. F. Minto; F/O. K. J. Nixon; Cpl. C. D. Pitman; Sgt. A. Rooks; Sgt. L. A. Rother; Sgt. P. J. Russ; Sgt. A. B. Solari; Sgt. E. P. Stock; Sgt. J. F. Thwaite; Sgt. N. E. Warrender; P/O. W. A. White; F/O. E. Williams.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW PRESUMED KILLED ON ACTIVE SERVICE.—F/O. R. A. H. Nelson.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Sgt. W. Day; Sgt. R. Spencer; Sgt. G. B. Stewart; Sgt. G. W. Turley.



COLD WORK : Aircraftmen sit on the chocks while a Martlet's engine is run up on the flight deck of a carrier in northern waters.

WOUNDED OR INJURED ON ACTIVE SERVICE.—L.A/C. L. Bourne; A/C.2 R. G. Crowe; L.A/C. H. Fergusson; L.A/C. A. Fleming; L.A/C. E. P. Hall; L.A/C. J. W. Powell.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—Sgt. D. Broughton.

DIED ON ACTIVE SERVICE.—L.A/C. C. Bailey; A/C.2 J. W. C. Blake; Sgt. J. Brown; L.A/C. H. W. McB. Bryce; A/C.1 R. A. J. Clements; A/C.1 J. Dudgeon; Cpl. S. A. Howard; Sgt. F. T. A. Jarvis; L.A/C. P. D. Razzell; L.A/C. A. J. Salter; A/C.1 P. A. Sands; Sgt. J. E. Savage; Sgt. A. Sutherland; L.A/C. H. Wright.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—F/O. C. E. L. Grant; Sgt. E. Morris.

Royal Australian Air Force

MISSING.—Flt. Sgt. V. S. Barnes; Flt. Sgt. A. W. Downing; Flt. Sgt. T. K. Forsyth; Flt. Sgt. S. C. Kitchen; Flt. Sgt. D. A. McCord; Flt. Sgt. A. B. Slade; W/O. A. R. Stratton.

KILLED ON ACTIVE SERVICE.—Flt. Sgt. G. B. Davies; Flt. Sgt. D. E. Ripper; P/O. E. M. Taylor.

Royal Canadian Air Force

KILLED IN ACTION.—F/O. J. L. Gibson.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. R. G. Hume.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—F/O. C. W. Gebhard; Sgt. R. J. Jones; Sgt. J. R. Richmond; P/O. A. E. Taylor; F/O. R. G. Tighe.

MISSING, BELIEVED KILLED IN ACTION.—F/O. J. Fearn.

MISSING.—Flt. Sgt. G. A. Shanks.

MISSING, BELIEVED KILLED ON ACTIVE SERVICE.—F/O. H. P. Ralph.

KILLED ON ACTIVE SERVICE.—F/O. H. A. Hague; Flt. Sgt. C. Johnston; Sgt. A. B. Levene; W/O. R. G. McIntaggart; Flt. Sgt. A. A. McLaren; Sgt. H. M. McLaughlin; Sgt. H. R. Thompson.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—Sgt. J. H. Graham.

Royal New Zealand Air Force

DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—Flt. Sgt. J. J. Purves.

MISSING.—W/O. G. N. Banks; F/O. A. T. Dance; Flt. Sgt. A. G. Fawcett; F/O. T. Lodge; F/O. N. C. B. Wilson.

KILLED ON ACTIVE SERVICE.—Flt. Sgt. P. Norton.

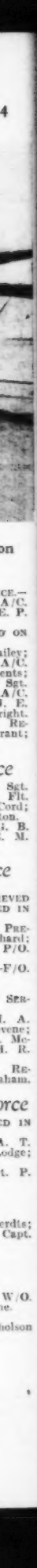
South African Air Force

MISSING.—Lt. C. L. Garlick; Lt. G. C. Geerdts; Flt. Sgt. C. J. Rapie; Lt. E. A. Thomas; Capt. P. A. Van Velzen.

Official Corrections

Casualty Communiqué No. 313.

Under "KILLED ON ACTIVE SERVICE," for W/O. V. P. Friese, read W/O. V. P. Friese-Greene.

Casualty Communiqué No. 314.

Under "MISSING," for Flt. Sgt. V. Nicholson read Flt. Sgt. V. Nicholson, D.F.M.